MECHANICAL ENGINEERING

January 1960

In Two Sections • Section One

A SPECIAL REPORT...The Nation's Water Resources, 31
INDUSTRIAL WATER • WATER MANAGEMENT • GROUND WATER • WATER WELLS • CREATING STORAGE

Developing Managerial Abilities, 29

The 2000 Hour Proteus Turboprop, 37

Feedback — Consumer to Factory, 41

Steam-Turbine Buckets — Automatically Milled, 44

Engineering Application of Digital Computers, 48

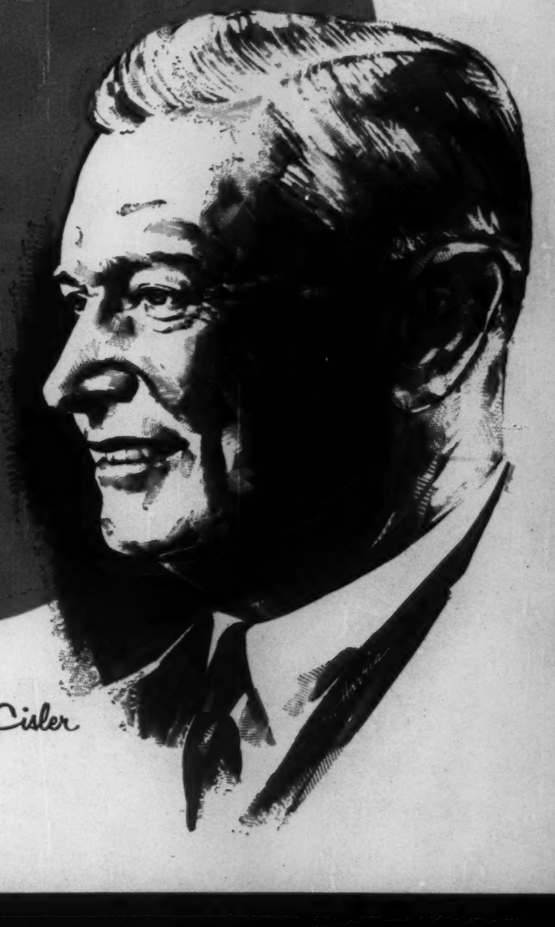
1959 ASME ANNUAL MEETING

Annual Meeting Report, 76

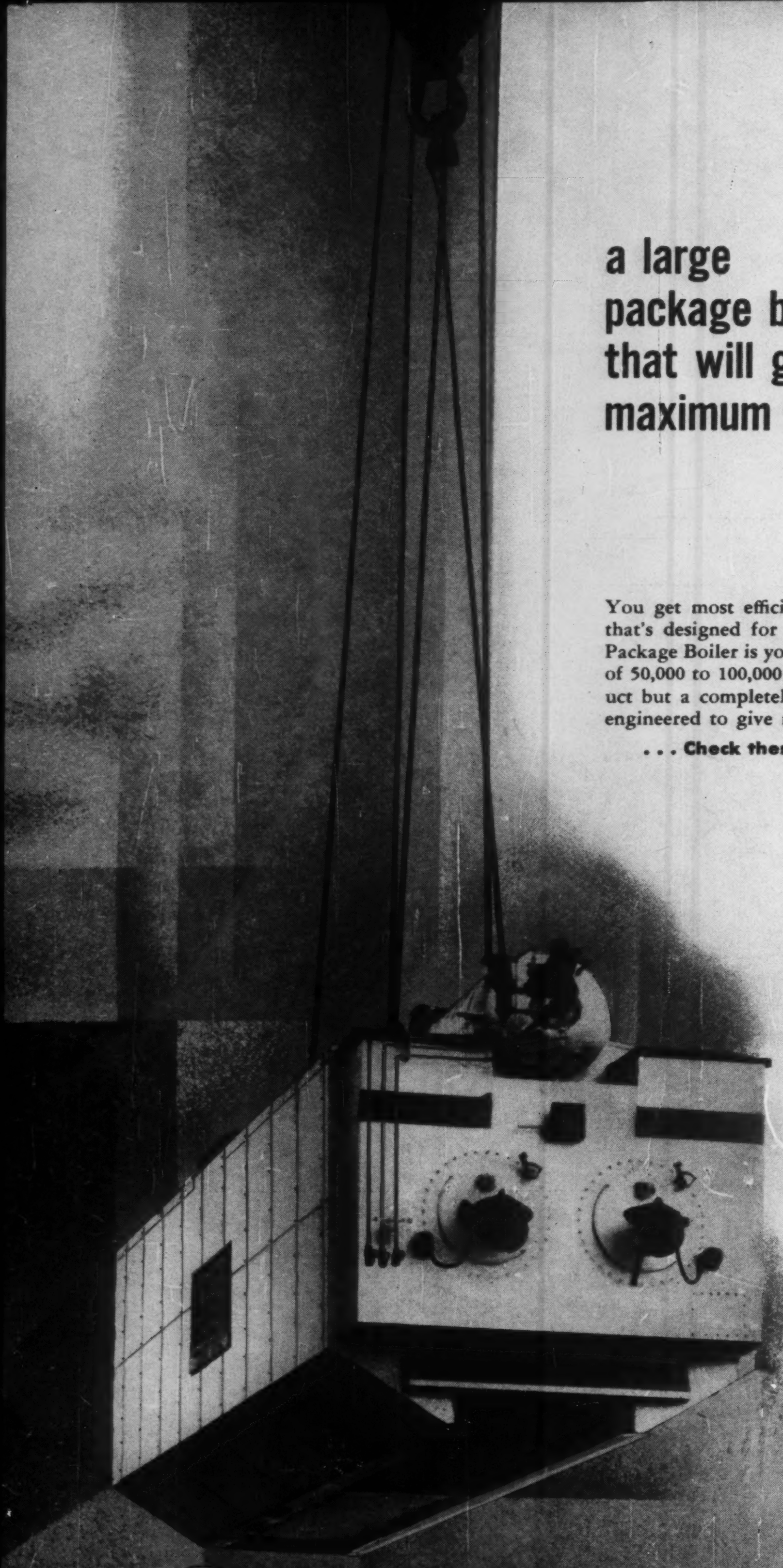
ASME Honors Engineers, 104

Woman's Auxiliary to the ASME, 111

Availability List, 114
OF ANNUAL MEETING PAPERS



The ASME President... Walker Lee Cisler



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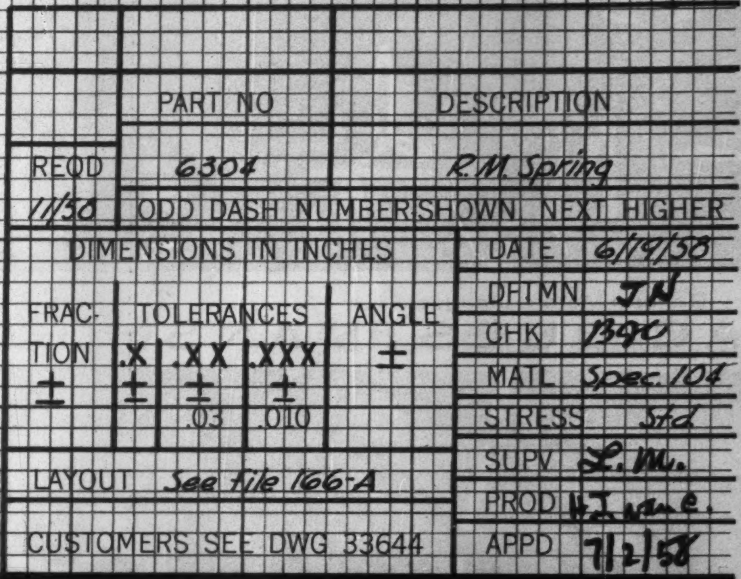
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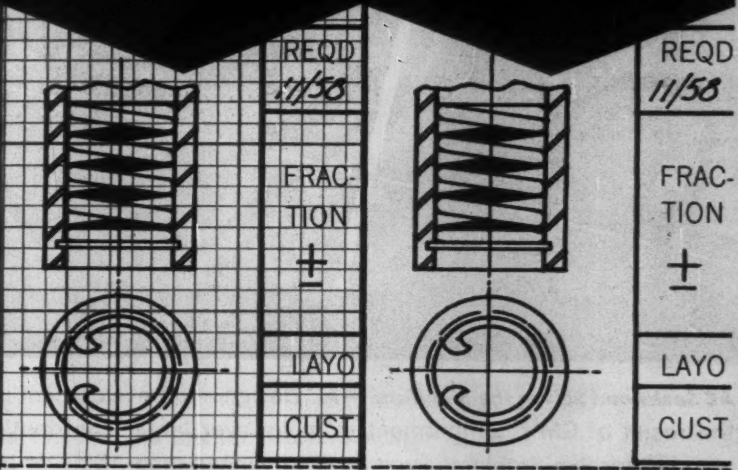
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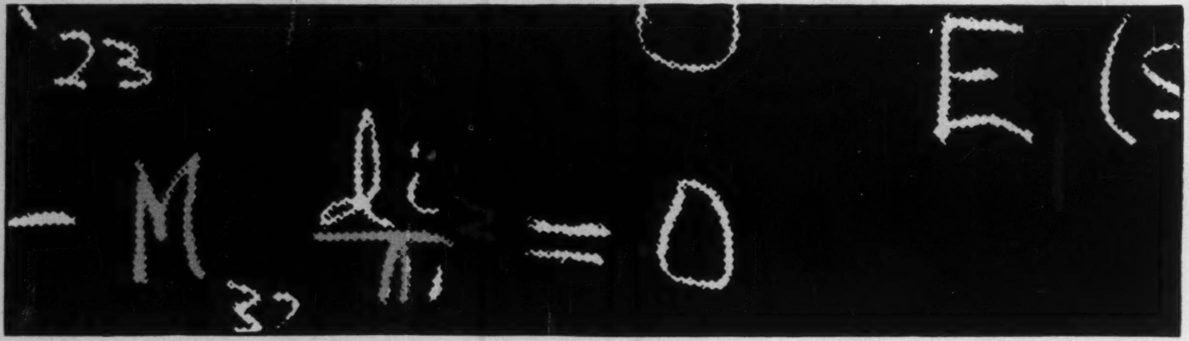

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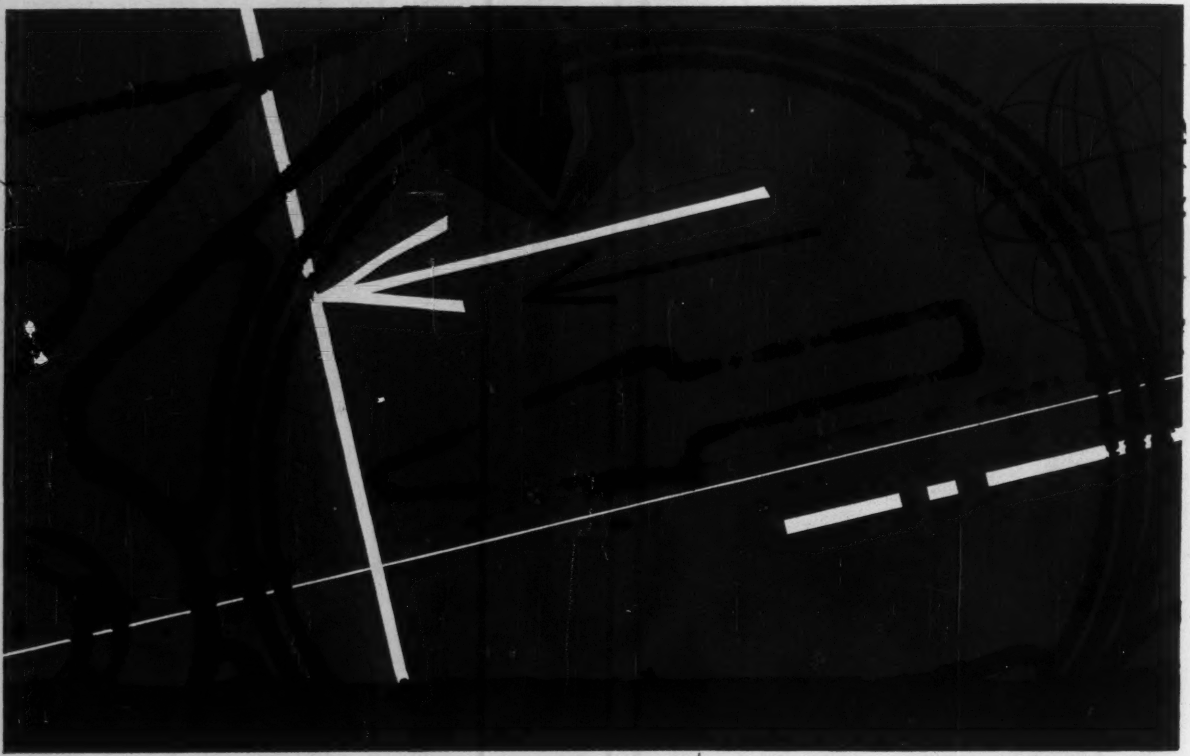

AC Seeks and Solves the Significant—AC Design and Development is moving far ahead in new technology—the result of GM's commitment to make ever larger contributions to the defense establishment. AC plans to resolve problems even more advanced than AChiever inertial guidance for Titan / This is AC QUESTMANSHIP. It's a scientific quest for the development of significant new components and systems . . . to advance AC's many projects in guidance, navigation, control and detection / Dr. James H. Bell, AC's Director of Navigation and Guidance, sees this as a "creative challenge". His group takes new concepts and designs them into producible hardware having performance, reliability and long life. He strongly supports the fact that an AC future offers scientists and engineers "a great opportunity to progress with a successful and aggressive organization" / If you have a B.S., M.S., or Ph.D. in the electronics, scientific, electrical or mechanical fields, plus related experience, you may qualify for our specially selected staff. If you are a "Seeker and Solver", write the Director of Scientific and Professional Employment, Mr. Robert Allen, Oak Creek Plant, Box 746, South Milwaukee, Wisconsin.

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MECHANICAL ENGINEERING
PUBLISHED BY
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Contents

VOLUME 82 • NUMBER 1 • JANUARY, 1960

THE COVER

New year, new President. Each December, ASME inaugurates a President, a leader chosen from the country's top mechanical engineers. For 1960, we shall enjoy the leadership of Walker Lee Cisler, who is also president of Detroit Edison and engineer-at-large to the National Government. (He is now Special Consultant to the Department of Defense, reviewing the organization and management of our missile-testing ranges and satellite-tracking facilities.) For a profile of President Cisler, see the editorial, pp. 27-28.

DEVELOPING MANAGERIAL ABILITIES.................... **F. F. Bradshaw** **29**

History records many examples—men who showed no early talent for leadership, but taught themselves the art. Here are the factors that must be present if mature men are to learn management.

THE NATION'S WATER RESOURCES **31**

Industrial Water.................................... **E. P. Partridge**
Water Management.................................... **K. S. Watson**
Ground Water.. **J. G. Ferris**
Water Wells... **Paul Weaver**
Creating Storage...................................... **G. H. Higgins**

Water is the universal solvent, but there is no easy solution to the water shortage that faces industry. ASME's Technical Development Committee turns the spotlight on this engineering problem.

THE 2000 HOUR PROTEUS TURBOPROP...................... **P. F. Green** **37**

Start with a rugged, tested engine. Develop it in service, until it runs 2000 hr between overhauls and the chances of failure grow more and more remote. That's how engines become great.

FEEDBACK—CONSUMER TO FACTORY.................... **R. E. McGarrah** **41**

Study in management: Must a 10 per cent drop in consumer buying provoke a 60 per cent drop in production? It's inevitable with one of the most commonly used systems of information feedback.

STEAM-TURBINE BUCKETS—AUTOMATICALLY MILLED.................
.... **R. H. Wilke and Abdon Rubio** **44**

Design a long, steam-turbine bucket, and you come up with airfoil shapes for as many as 24 cross sections. The production problem? At GE they've applied numerical control to the milling operation.

ENGINEERING APPLICATION OF DIGITAL COMPUTERS....... **H. D. Irwin** **48**

In a matter of minutes, a digital computer completes a calculation that would take a mathematician two weeks. Will it justify its cost to industry? Here is the view of a practicing engineer.

1959 ASME ANNUAL MEETING REPORT.................................... **76**

ASME HONORS ENGINEERS.. **104**

WOMAN'S AUXILIARY TO THE ASME...................................... **111**

AVAILABILITY LIST—Annual Meeting Papers............................ **114**

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Contents continued on following page

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An announcement of the transfer of welding fittings operations from Milwaukee to Beaver Falls will be made in the near future.

For further details ask for bulletin FDM-2016 or call on any of the local B&W District Sales Offices. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

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Contents (continued)

VOLUME 82 • NUMBER 1 • JANUARY, 1960

Departments

ENGINEER 25
EJC News 26 International Affairs
Briefs 25 26 Education
National Affairs 25 26 EJC Publications

EDITORIAL 27

BRIEFING THE RECORD 51
Rotating Combustion Engine 51 56 Machine-Tool Innovations
Magnetohydrodynamic Power Generation 52 57 Koppers Blast Furnace
57 "Dynatrol" Vertical Turret Lathes
Smog Eye Irritants Identified 53 58 Blast Descaling
Diamond-Making Process Revealed 53 58 30 Million Words a Second
Peak-Load Power Plant 54 58 Fish-Scale Concrete
Nuclear Carrier "Enterprise" 54 59 Pyrographite for 6700 F
Push-Button Telephones 54 59 "Recomp II" Computer
Little Zipster 55 60 Nuclear Briefs
Ektalith Document Reproduction 55 61 Materials Briefs

PHOTO BRIEFS 62
Commuter Express 62 62 Portable Fathometer
Welding Positioner 62 62 Tree Crusher
SABER 62 62 Roll Clamp
Supersonic Wind Tunnel 62 62 Flying-Spot Store

EUROPEAN SURVEY 64
Three New Ship Model Basins, 64

ASME TECHNICAL DIGEST 66
Instruments and Regulators 66 71 Machine Design
Aviation 67 72 Fluid Meters
Hydraulics 68 73 Metals Engineering
Gas Turbine Power 68 74 Applied Mechanics
Production Engineering 70 74 ASME Transactions for December, 1959

COMMENTS ON PAPERS 118

BOOKS RECEIVED IN LIBRARY 118

ASME BOILER AND PRESSURE VESSEL CODE 119

THE ROUNDUP 122
International Rubber Conference 122 124 Research
Power Boiler Industry 122 125 People
Education 123 126 Industrial Films
Literature 123 126 Coming Meetings
Automatic Control Conference 123 126 Meetings of Other Societies

THE ASME NEWS 127
ASME Gas Turbine Power and Hydraulic Conference 127 130 Freeman Fellowship
National Automatic Control Conference 128 130 1960 Nuclear Congress
131 ASME Elects Seven Fellows
ASME Coming Events 129 133 Junior Forum
Applied Mechanics Reviews Reports Growth 129 135 Engineering Societies Personnel Service
1960 RAC Meetings Schedule 130 137 Candidates
138 Obituaries

KEEP INFORMED .... 141 184 .... **CONSULTANTS**

CLASSIFIED ADS .... 175 186 .... **ADVERTISING INDEX**

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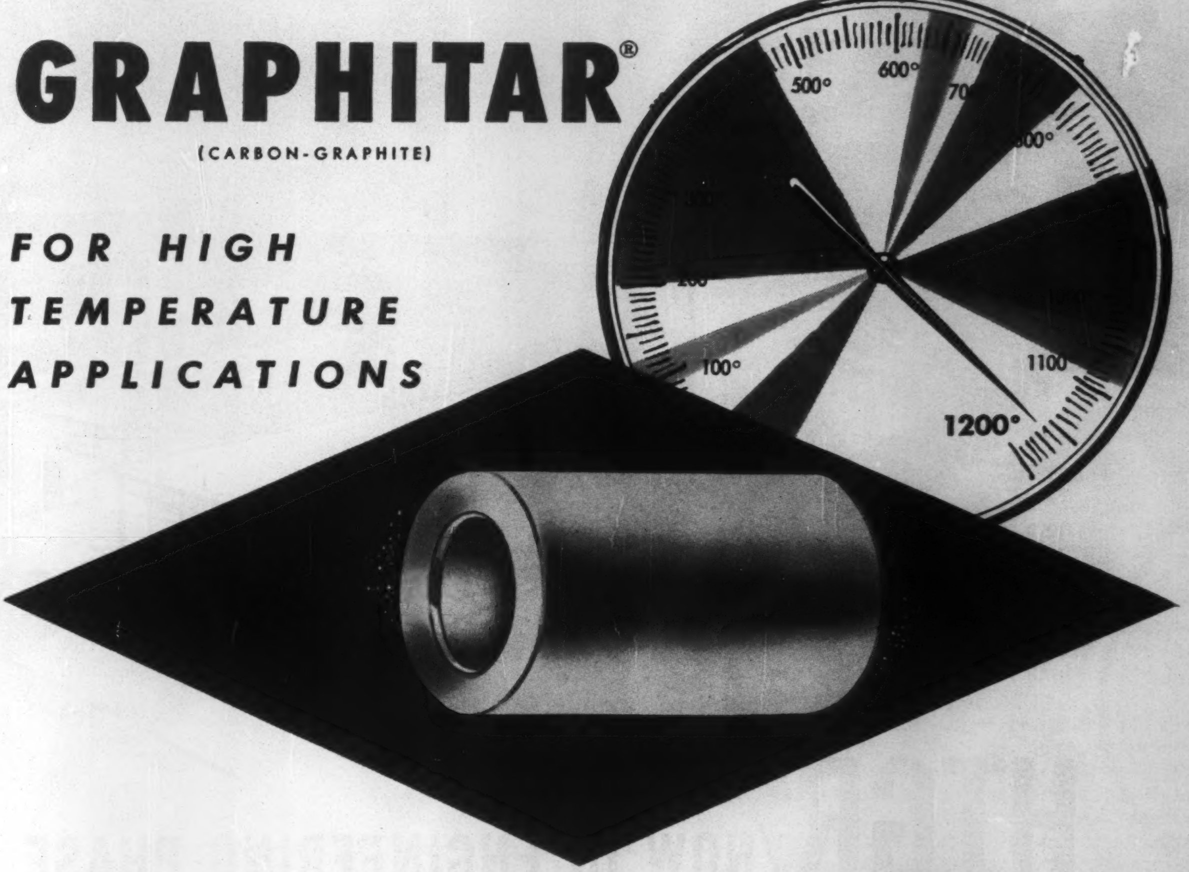

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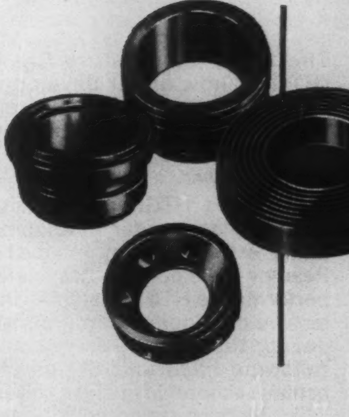

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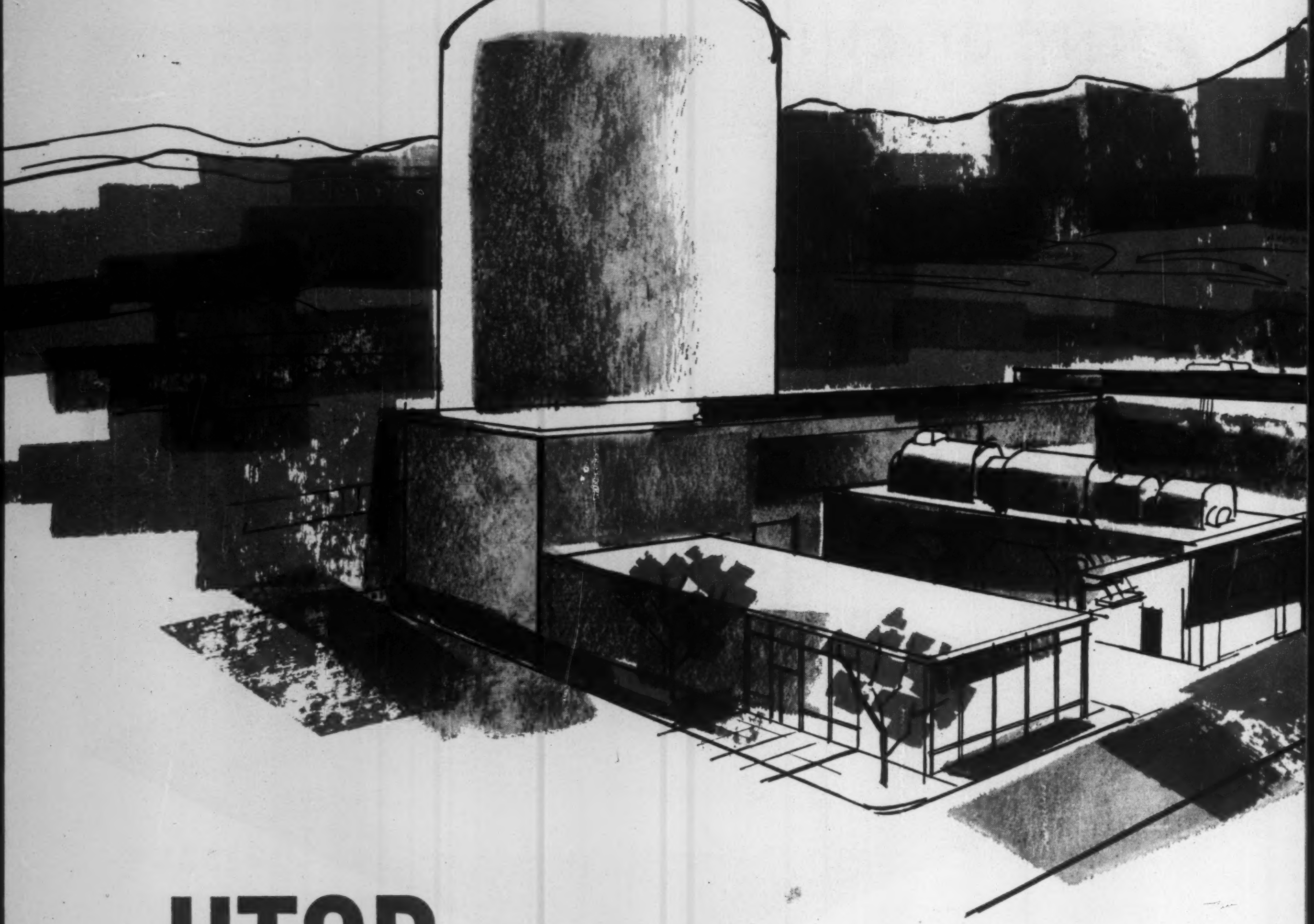


HTGR/NOW IN ENGINEERING PHASE

The High Temperature Gas-cooled Reactor (HTGR), now under development at General Dynamics Corporation's General Atomic Division, has as its promising goal an important short cut to the nation's objective of truly economic nuclear power.

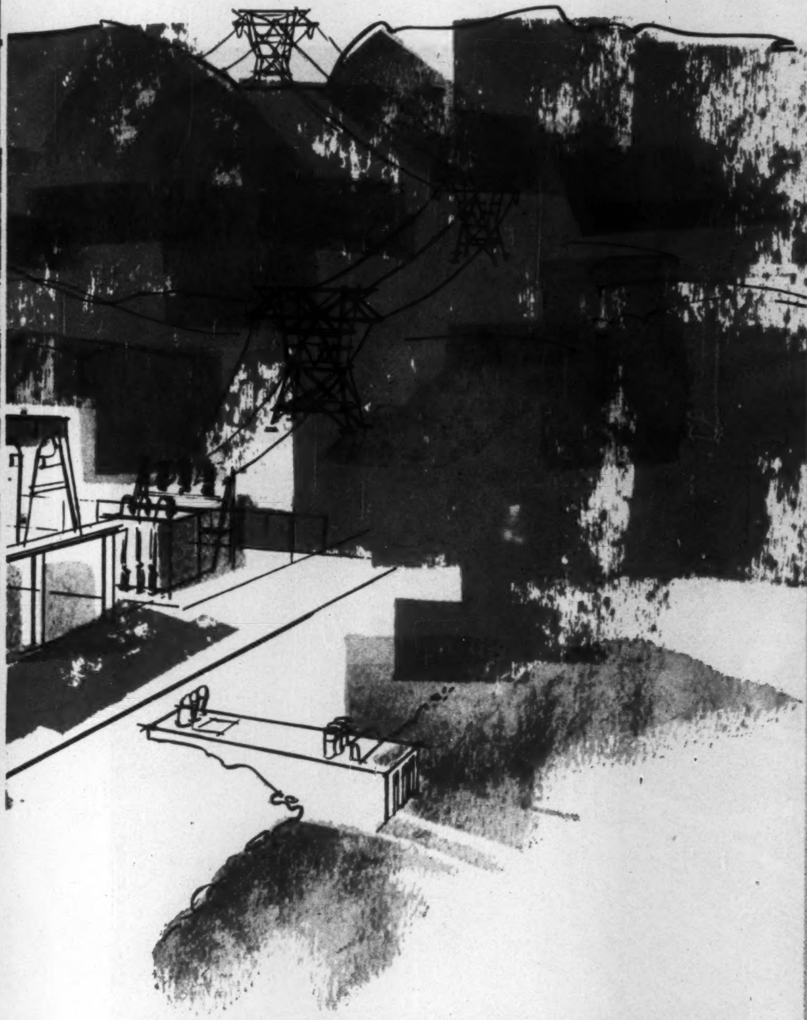
A prototype HTGR plant designed for 40,000 KW(E) is now under development for Philadelphia Electric Company and the High Temperature Reactor Development Associates, Inc. The high performance HTGR system — the result of an extensive development program at General Atomic during the past three years — embodies the following important design characteristics to achieve economic nuclear power:

1. Modern steam conditions of 1000° F and 1450 psi.
2. A helium gas outlet temperature of 1380° F resulting in an economical and compact heat exchanger system.
3. Fuel burnup of the homogeneous UThC fuel in the 50,000-100,000 MWD/ton range.

The important design features which make it possible to achieve these characteristics include the HTGR's unique graphite fuel-moderator elements, which permit operation at very high temperatures.

Work in progress at General Atomic's John Jay Hopkins Laboratory in San Diego, Calif., will by 1963 result in the completion of construction* of the prototype HTGR plant at Peach Bottom in York County, Pa., on the system of the Philadelphia Electric Company. Associated with the Philadelphia Electric Company in the project are 52 other utility companies comprising the High Temperature Reactor Development Associates. This is the largest and most widely representative group of utilities to support a single nuclear power project thus far in the United States.

*Bechtel Corporation is prime contractor-engineer constructor for the plant, with the nuclear steam supply system designed and supplied by General Atomic Division.



Member companies of High Temperature Reactor Development Associates include:

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Openings For Engineers In Nuclear Reactor Design

Rapid expansion of the High Temperature Gas-cooled Reactor and other major programs at General Dynamics' General Atomic Division has created increased engineering activity leading to openings, including senior positions, in reactor design and development.

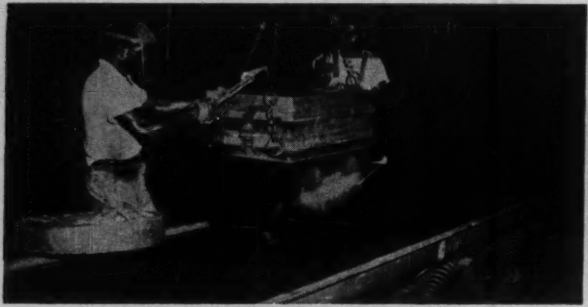
In the important area of nuclear engineering, immediate openings exist for men qualified to perform thermal analyses of reactor cores . . . reactor design neutronic calculations . . . analyses of reactor and system controls . . . structural design of reactor components . . . and the design of mechanisms such as control drives and fuel charging systems associated with the reactor. There are also openings in the HTGR program for qualified metallurgists, physicists, chemists and chemical engineers, materials specialists, mathematicians, and programmers.

Inquiries are also invited from senior men qualified to conduct studies of new applications of nuclear energy in the power generation, transportation, space propulsion, and chemical fields.

Besides HTGR, other programs presently in progress at General Atomic include the MGCR gas-cooled reactor and closed-cycle gas turbine system for merchant ship propulsion . . . TRIGA reactors for research, training, and isotope production . . . small nuclear power systems . . . test reactors . . . nuclear power for space vehicles . . . direct conversion of heat to electricity . . . and research in controlled thermonuclear reactions.

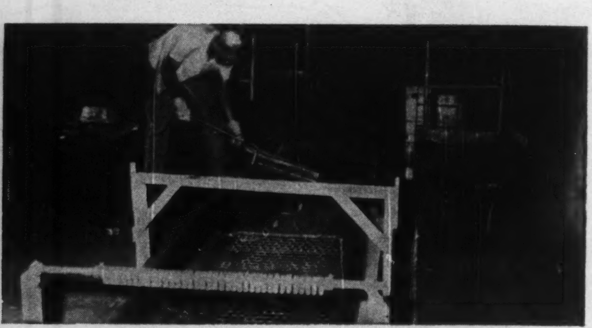
For further information on these openings, write: Manager of Personnel, General Atomic, P.O. Box 608-S, San Diego 12, California.

Reactor Core — High Temperature Gas-cooled Reactor



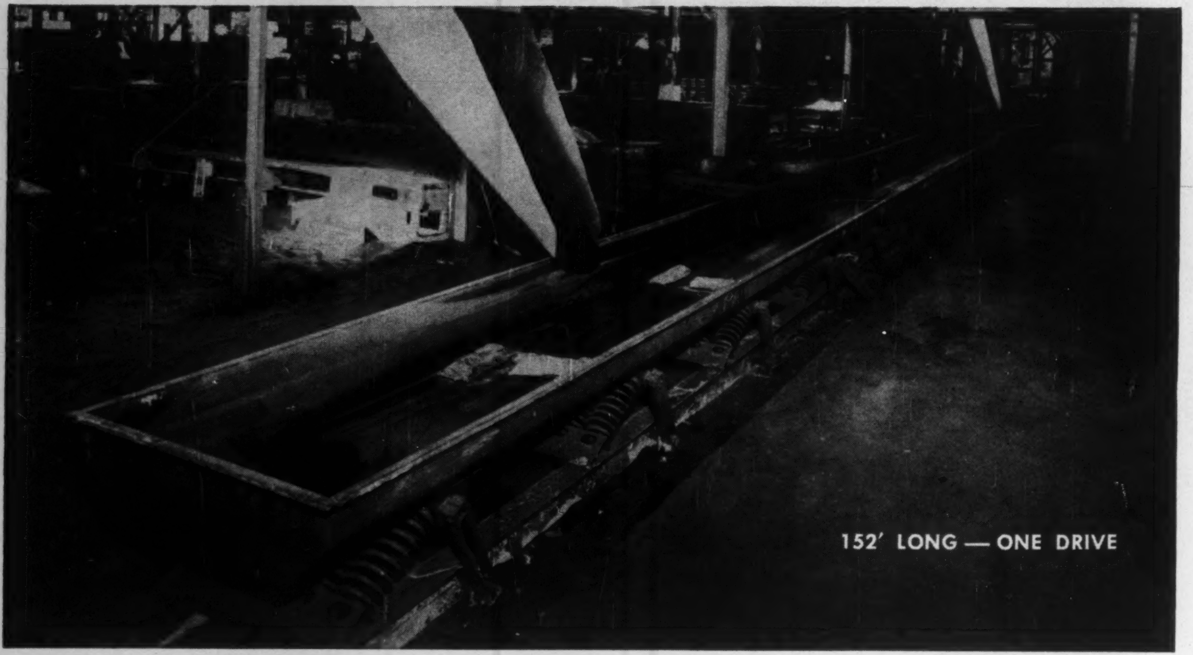
RUGGED

Impact of hot sand, castings no problem.



VERSATILE

Built-in shakeout with lump-breaker separates sand and castings.



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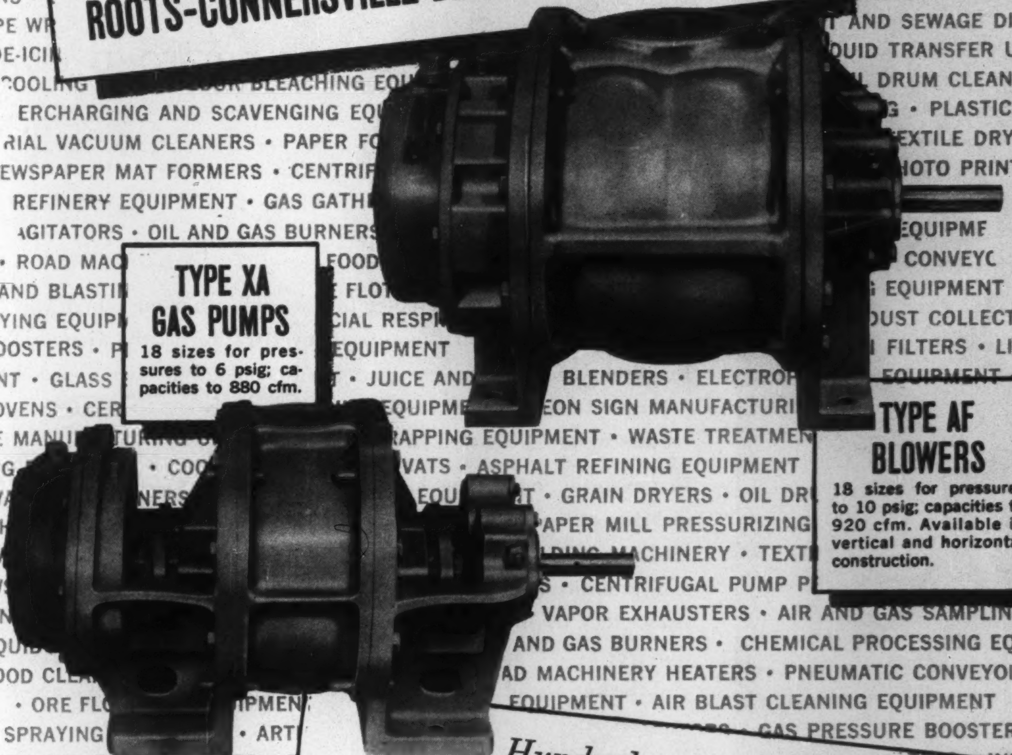

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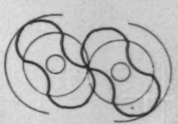

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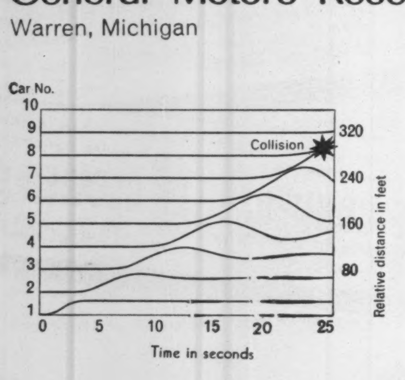
Resolving the driver-car-road complex

The manner in which vehicles follow each other on a highway is a current subject of theoretical investigation at the General Motors Research Laboratories. These studies in traffic dynamics, coupled with controlled experiments, are leading to new "follow-the-leader" models of vehicle interaction.

For example, conditions have been derived for the stability of a chain of moving vehicles when the velocity of the lead car suddenly changes — a type of perturbation that has caused multiple collisions on modern superhighways. Theoretical analysis shows that the motion of a chain of cars *can be stable* when a driver accelerates in proportion to the relative velocity between his car and the car ahead. The motion is always unstable when the acceleration is proportional only to the relative distance between cars. Experimentally, GM Research scientists found that a driver does react mainly to relative velocity rather than to relative distance, with a sensitivity of reaction that increases with decreasing distance.

Traffic dynamics research such as this is adding to our understanding of intricate traffic problems — what causes them, how they can best be resolved. The study is an example of the ways GM Research works to make transportation of the future more efficient and safe.

General Motors Research Laboratories
Warren, Michigan



Relative positions of 10 hypothetical cars after lead car goes through maneuver. Amplitude of instability increases, resulting in a collision between 7th and 8th cars.

Valves for Power Plants

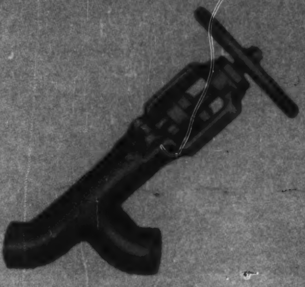


Fig. 1314 A—1500-Pound Integral bonnet steel "Y" Valve.

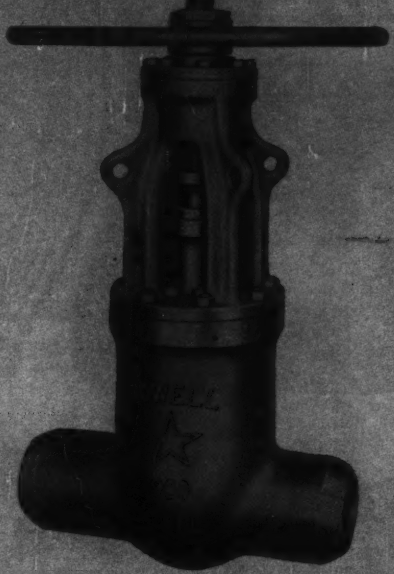


Fig. 19003—Powell Steel Pressure Seal Gate Valve for 900 pounds W.S.P.

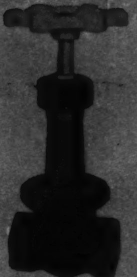


Fig. 375—Bronze Gate Valve for 200 pounds W.S.P. Union bonnet, inside screw rising stem.

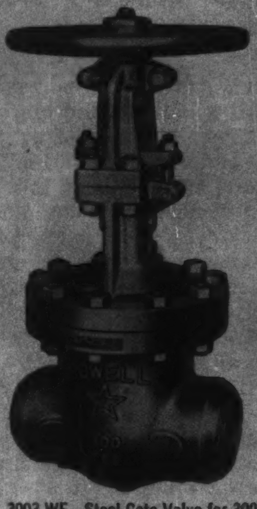


Fig. 3003 WE—Steel Gate Valve for 300 pounds. Outside screw rising stem and yoke.

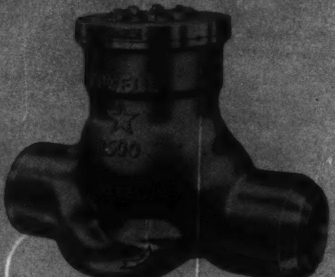


Fig. 11365—Steel Pressure Seal Horizontal Lift Check Valve for 1500 pounds.

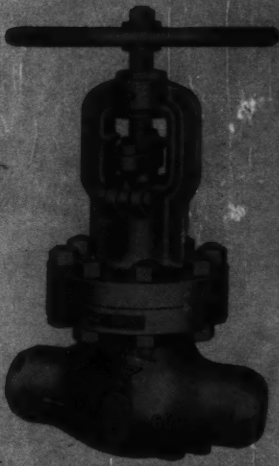


Fig. 6031 WE—600-Pound Steel Globe Valve for steam service. Outside screw stem and yoke.

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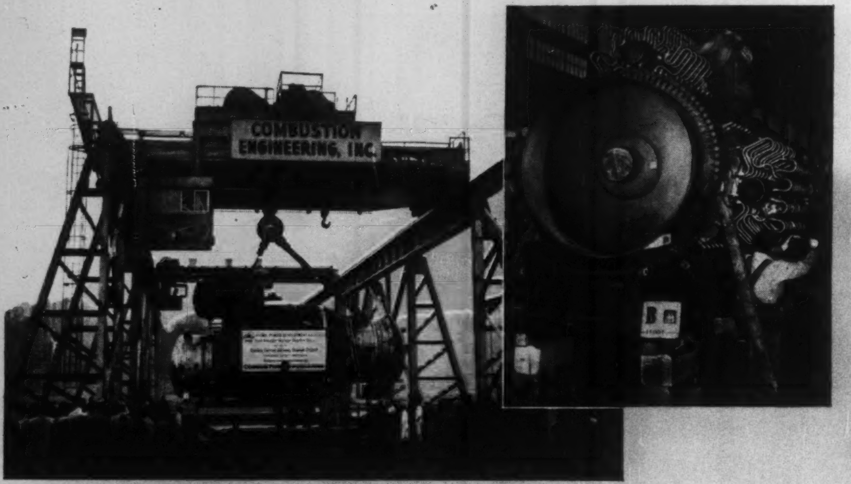
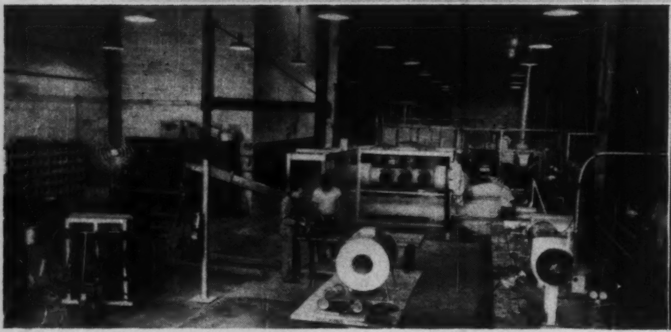


(Left) The huge riverside crane at Combustion's Chattanooga Division easily lifts this 92-ton stainless steel reactor vessel — the most complex reactor vessel built to date — into a barge for shipment to the Enrico Fermi Power Station, Lagoona Beach, Michigan.
(Right) Stainless steel sodium heat exchanger consisting of a series of tubes within tubes, encased in a pressure vessel.

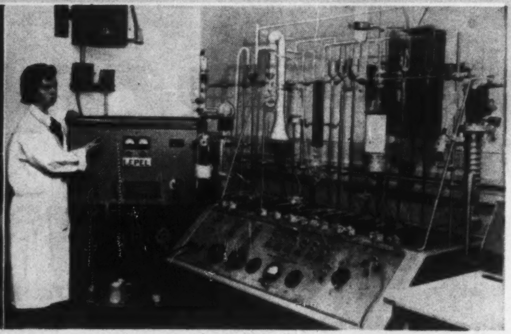
What C-E is doing to advance

The strange and wondrous world of the atom has been examined and surveyed by C-E scientists and engineers since 1946. The object—to put the controlled energy of the atom to productive use for the generation of power. The result—a wealth of knowledge and experience in the application, design and manufacture of nuclear power equipment. Backed by specially designed laboratories and manufacturing facilities, this knowledge and experience—greatly augmented and enriched by the acquisition of the General Nuclear Engineering Corporation early last year—has enabled C-E to undertake many kinds of nuclear work.

Notable C-E and General Nuclear projects are outlined on the opposite page. Virtually all of them are *current*, and many have a significant relationship to the vital task of making nuclear power competitive with conventional power. Collectively, these projects will contribute importantly to the Company's objective of achieving the same position of leadership in the atomic world of tomorrow which it has long since achieved in present-day methods of power generation.



Partial view of laboratory of General Nuclear Engineering Corporation at Dunedin, Florida, showing equipment used for the study of a high-pressure, high-temperature gas coolant system.



Portion of a laboratory at C-E's Nuclear Division, Windsor, Connecticut, showing gas analysis equipment used for detecting the presence of small quantities of gases in reactor materials.

The 520-foot-long Heavy Vessel Bay at C-E's Chattanooga Division was created especially for the manufacture of heavy nuclear components.

Portion of the 530-acre site occupied by C-E's Nuclear Division at Windsor, Connecticut. This Division is equipped for the development, design and test of reactor systems and the manufacture of reactor cores and core components.

Nuclear Power Progress

C-E NUCLEAR PROJECTS

For Electric Power Stations

- In association with Stone & Webster Engineering Corporation, a design study for AEC of an advanced type of large (236,000 kw) pressurized water reactor power plant.
- A long-term development program for AEC to determine the best means of using nuclear energy to generate superheated steam. (Success in this endeavor will be a big step forward in reducing the cost of nuclear-generated power.)
- Design studies for the Puerto Rico Water Resources Authority, under AEC contract, to determine the best means of adding nuclear superheat to a boiling water reactor.
- Design, research and development work covering a gas-cooled, heavy-water-moderated, pressure-tube type reactor for the East Central Nuclear Group, Inc., and the Florida West Coast Nuclear Group. This development will also lead to a nuclear power plant using superheated steam.
- The development and test of various kinds of fuel elements and fabricating procedures, under contract with the AEC.
- The design and manufacture of reactor vessels, including the largest and most complex vessels of their type built to date, for the Shippingport Station (America's first full-scale atomic power plant), the Enrico Fermi Atomic Power Plant, the Humboldt Bay Nuclear Power Station, and Italy's first nuclear power plant.

For Military Power Plants

- Design study for U. S. Army, under AEC contract, of a truly package type of nuclear reactor, using the boiling water concept, for remote installations. This program includes operation of a prototype boiling water reactor at the National Reactor Testing Station in Arco, Idaho, and the training of military technicians in the operation of the installation.
- The conceptual design and operation of a nuclear test reactor, under AEC contract, to permit full-scale testing of prototype reactor cores for military field plants.

For Naval Power Plants

- The design and manufacture of a submarine reactor system designed to set new standards of accessibility, speed of startup and operational flexibility—and the operation of a land-based prototype installation.
- The design and manufacture of numerous reactor cores, reactor vessels, steam generators and pressurizers for various types of submarines and naval surface ships.

For Merchant Ship Propulsion

- The design and engineering study of a prototype pressurized water reactor for a 45,000-ton tanker, under contract with the AEC and the U. S. Maritime Commission.

Special Studies and Services

- Irradiation studies, fabrication studies, evaluation studies of the general properties of materials, quality control, isotopic analyses, strain gauge and photoelastic testing, basic and applied research in ferrous metallurgy.
- Bio-assays, decontamination, environmental monitoring, radiochemical analyses and radiological safety programs.

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C-248

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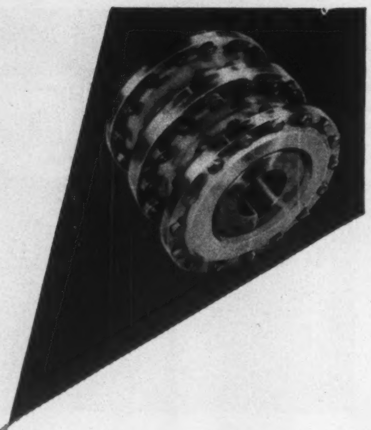
the basic coupling principle that couldn't be improved . . .



This principle makes every Fast's coupling . . . large or small . . . out-perform all others

The principle embodied in Koppers gear-type, self-aligning Fast's couplings couldn't be improved by anyone. Throughout industry, Fast's couplings are accepted as the most dependable couplings on the market. Experience has proved that they frequently *outlast the equipment* they connect.

Fast's couplings are sufficiently comprehensive in types, sizes and versatility to meet almost every known need for couplings. Available in forged steel for shaft sizes from ¾″ to 6⅝″ and in cast steel for shaft sizes from 5½″ to 32″.

Nearly 40 years of coupling experience guarantees that Koppers can supply the right coupling engineered for a given application. For the booklet describing Fast's couplings applicable to your equipment, write today to: KOPPERS COMPANY, INC., Fast's Coupling Department, 5701 Scott Street, Baltimore 3, Maryland.

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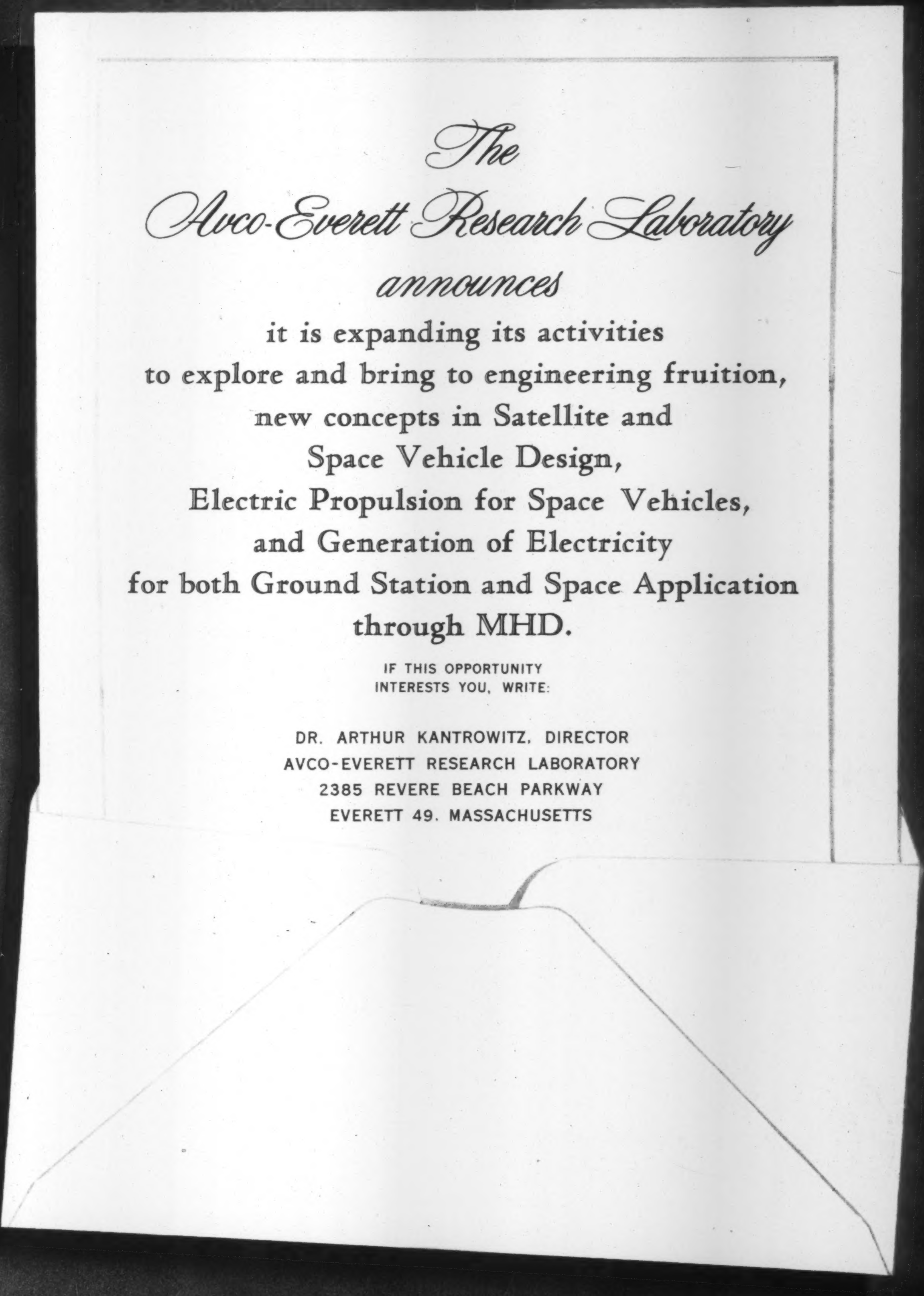
Engineered Products Sold with **Service**



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announces

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new concepts in Satellite and
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and Generation of Electricity
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AVCO-EVERETT RESEARCH LABORATORY
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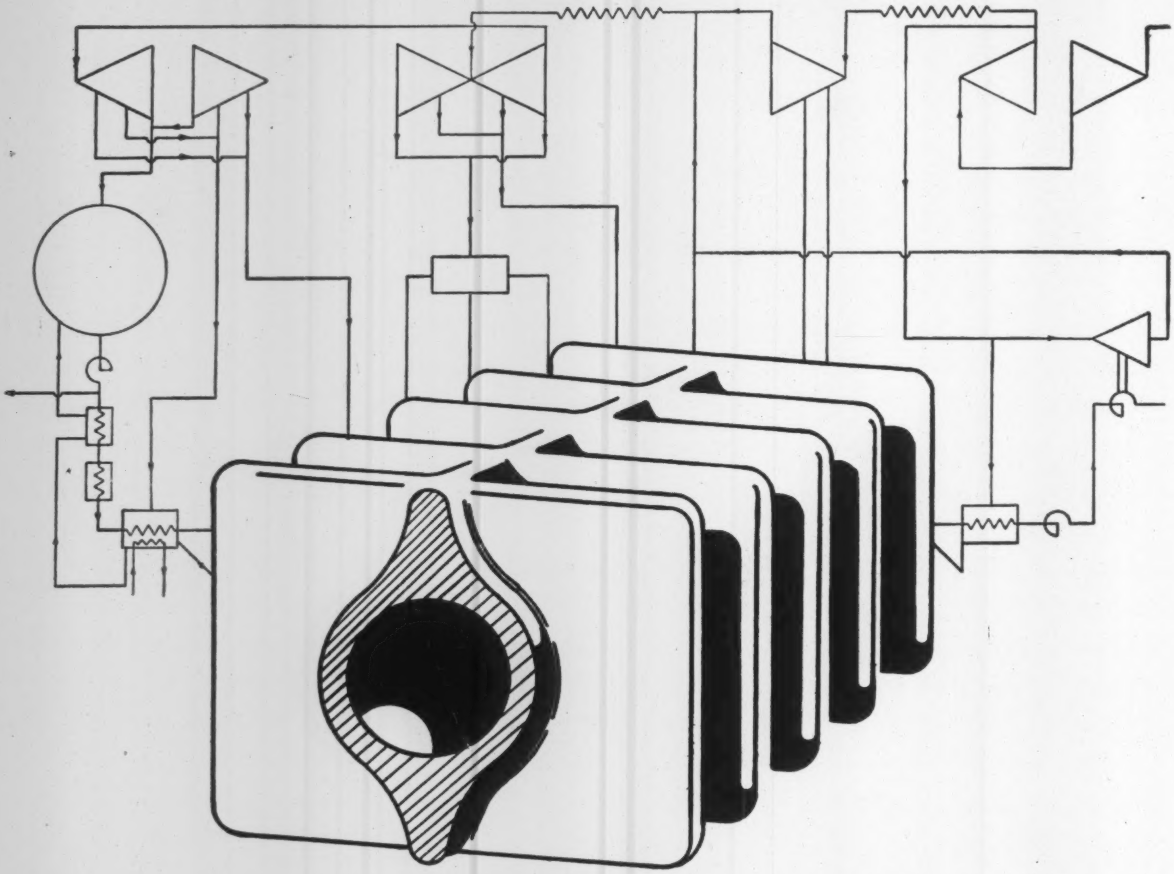


Green's Low-Level Economizer belongs on your steam cycle flow diagram!

Why has Green's Low-Level Economizer already been purchased for inclusion in several large units scheduled for operation in 1960, 1961 and 1962?

1. It is accepted that low-level heat recovery offers the most economic method of obtaining the lower heat rates required today.

2. Flue gas-to-water heat exchange transfers the low temperatures from the airheater to the Low-Level Economizer where the problems of corrosion and plugging can be adequately resolved.

Green has had over 100 years of economizer experience. It is yours for the asking.

Green

THE GREEN FUEL ECONOMIZER CO., INC.

BEACON 3, NEW YORK

ASSIGNMENT: CORROSION

How Lukens *Application Research* can help you find the right steel plate for the job

Migrating ions—superimposed on a photomicrograph of corroded steel plate—symbolize one of metallurgy's oldest assignments: the battle against corrosion. Developing new tactics in this constant campaign is the job of our Application Engineering staff.

For example, called on early in the planning stages, Lukens engineers recently attacked almost identical problems for two large processing companies—and came up with two completely different solutions.

The first involved a sugar refiner's vacuum pans. Frequent and costly cleaning was required to head off corrosion and product contamination. Our staff's prior research and experience in the food equipment field led it to suggest *nickel*-clad steel for the pans. (13% and 8% nickel-clad on A-285 backing steel.)

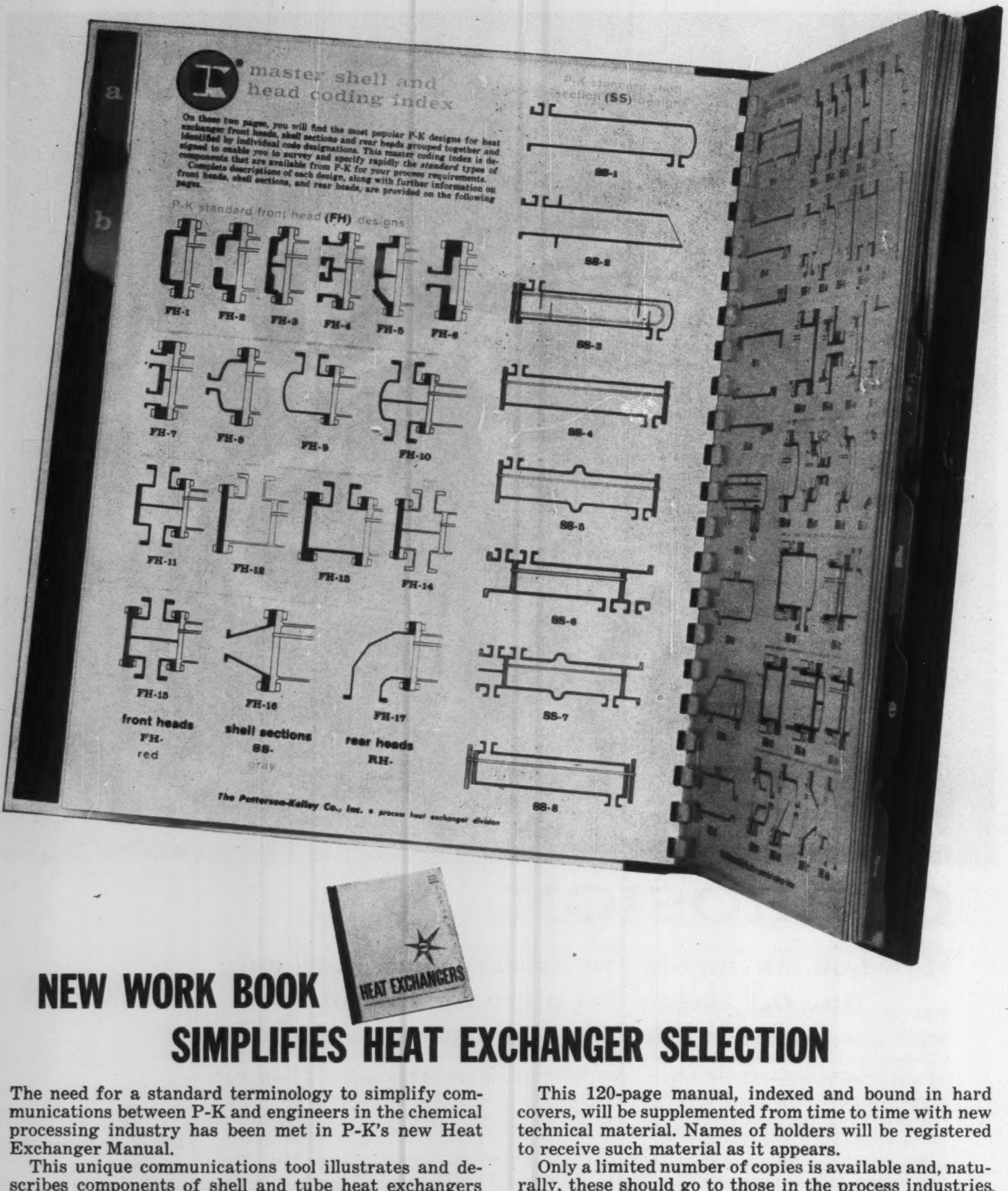
Cleaning and maintenance were equally costly to a leading chemical and dye company—in the protection of its nitrogen solution barge tanks. Here, our engineers found *stainless*-clad steel the most desirable answer. (12% 304L on A-212 backing steel.)

Armed with practical as well as technical knowledge of Lukens' wide range of special-duty steels, our Application Engineers have helped conquer corrosion on many fronts. That's why we say . . . *if your assignment is corrosion, let it be our assignment, too.* Contact Manager, Application Engineering, G-10 Services Building, Lukens Steel Company, Coatesville, Pa.

Helping Industry Choose Steels That Fit The Job

LUKENS

ASK FOR THE BULLETIN ON LUKENS CLAD STEELS



master shell and head coding index

On these two pages, you will find the most popular P-K designs for heat exchanger front heads, shell sections and rear heads grouped together and identified by individual code designations. This master coding index is designed to enable you to survey and specify rapidly the *standard* types of components that are available from P-K for your process requirements.

Complete descriptions of each design, along with further information on front heads, shell sections, and rear heads, are provided on the following pages.

P-K standard front head **(FH)** designs

P-K standard shell section **(SS)** designs

front heads
FH-
red

shell sections
SS-
gray

rear heads
RH-

The Patterson-Kelley Co., Inc. • process heat exchanger division

NEW WORK BOOK SIMPLIFIES HEAT EXCHANGER SELECTION

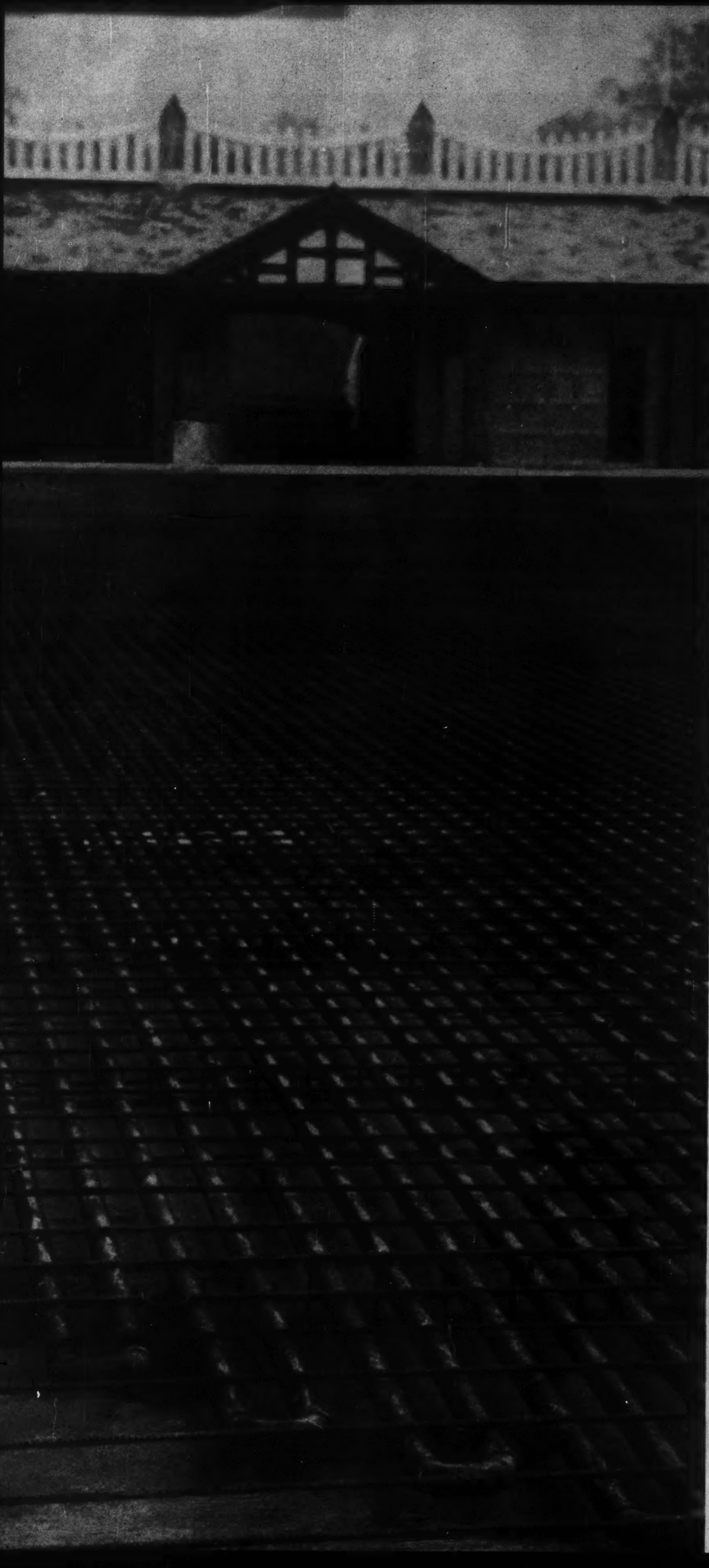
The need for a standard terminology to simplify communications between P-K and engineers in the chemical processing industry has been met in P-K's new Heat Exchanger Manual.

This unique communications tool illustrates and describes components of shell and tube heat exchangers commonly used in processing. A complete system of interchangeable front heads, shells and rear heads is established. Fundamentals of heat transfer and design are reviewed. Even economic considerations are discussed. The simple, certain nomenclature saves time, effort and duplication of engineering work.

This 120-page manual, indexed and bound in hard covers, will be supplemented from time to time with new technical material. Names of holders will be registered to receive such material as it appears.

Only a limited number of copies is available and, naturally, these should go to those in the process industries who will benefit most from the information we have compiled. If you design or specify heat exchangers, write us on your company letterhead, outlining briefly areas of your interest. A few copies are available to students and non-technical personnel at a nominal charge. Patterson-Kelley Co. Inc., E. Stroudsburg, Pa.

Patterson Kelley
Heat Exchanger Division



4-D

48,000 FEET OF WROUGHT IRON PIPE PROTECT THIS $200,000 ICE RINK AGAINST CORROSION

◀ The White Plains, N.Y., Municipal Rink in Recreation Park is a year-round fun-spot. In the winter: uninterrupted ice skating. In summer: roller skating, square dancing, basketball, volleyball, tennis and free concerts.

Miles of 4-D Wrought Iron Pipe help this municipality clear its biggest maintenance hurdle: rink piping corrosion.

Brines will attack just about any piping material. That's why designers of this rink had to be extra-sure. So they specified 1¼-inch diameter 4-D Wrought Iron Pipe to carry the brine needed to help form a smooth hard surface of ice. Every time. Without any leaky interruptions.

4-D Wrought Iron's composition and structure—high purity base metal laced with thousands of glasslike iron silicate fibers—is unique indeed alongside ordinary piping materials. Its steadfast resistance to corrosion is a proven cost-cutter in skating and curling rinks everywhere.

Are you piping for permanence? Here's an important first step: write for our special report "Ice Skating Rinks—Their Construction and Maintenance." A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

Perfect bends in pipe at header area of circulating system reflect 4-D Wrought Iron's easy working properties. Peter Carver Associates of New York City was the design engineer. Armeco Ventures fabricated and installed the coils at the site.

BYERS 4-D WROUGHT IRON

TUBULAR & FLAT ROLLED PRODUCTS
Also Electric Furnace Amballoy Steels
and PVC Pipe, Sheet & Rod Stock
Corrosion costs you more than Wrought Iron

Another addition to the Vogt line of TOP QUALITY valves . . .

Forged Steel
WELDED BONNET

GENERAL **GP** PURPOSE

Gate and Globe
VALVES

150-800 Pounds Service

To eliminate forever potential body-bonnet leaks, Vogt engineers have developed these new General Purpose valves with seal welded bonnet joints.

This new addition to the world's most complete line of forged steel valves incorporates all the features of other Vogt GP valves—hard faced seats, hardened stainless steel wedges, drop forged pressure parts, and the numerous other advantages of Vogt's valve line.

The desirable safety feature of a back seat on the stem is retained while still offering the elimination of a possible body-bonnet leak.

Available NOW in both gate and globe types, ¼" thru 2", and in both socket weld and screw ends. These are priced identical to the bolted bonnet GP valves; gate valves the same as Series 12111 and globe valves the same as Series 12141.

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Series 2801 Gate Valve
Illustrated

Series 2821 Globe Valve
Also Available

Both series identical in dimensions and have 13% chrome stainless steel trim.

HENRY VOGT MACHINE COMPANY, Louisville, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas,
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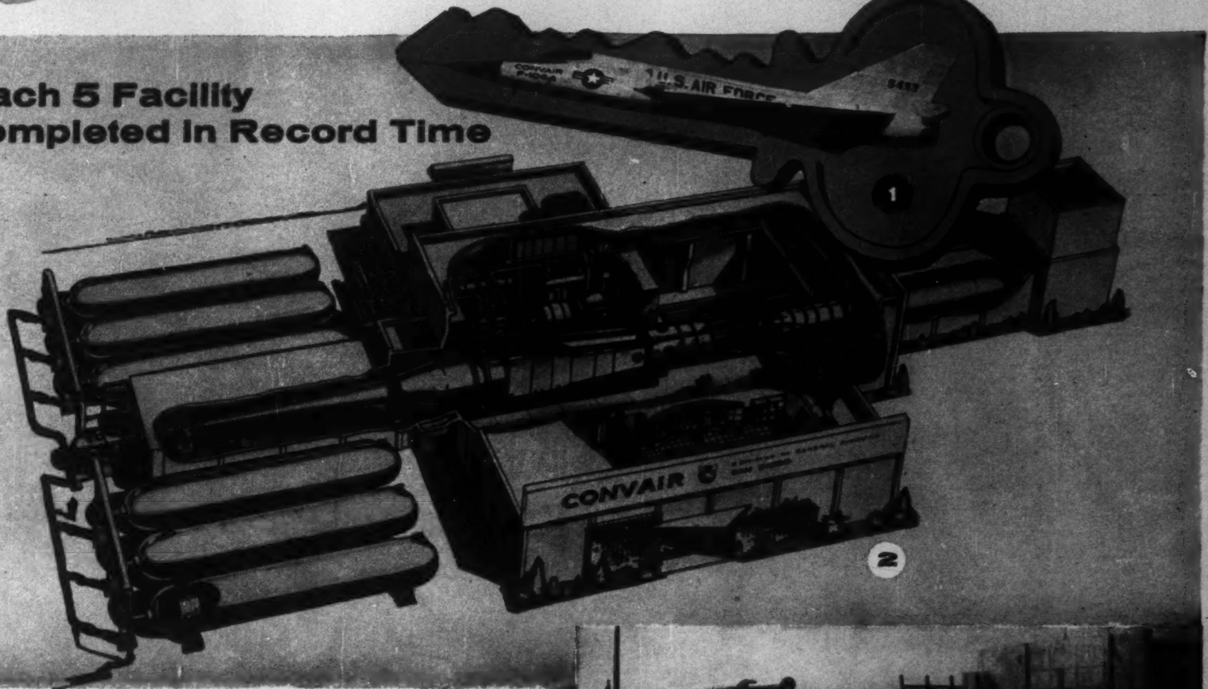
FOR BETTER VALVES

Vogt GENERAL **GP** PURPOSE **FORGED STEEL VALVES**

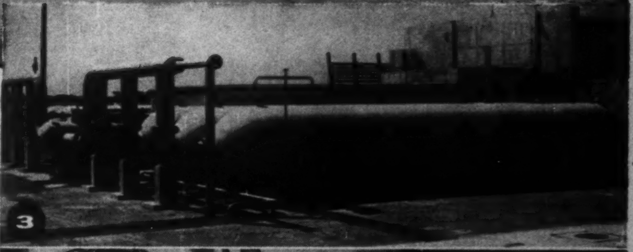
CB&I turns the key on construction of Convair Supersonic Wind Tunnel

Mach 5 Facility Completed in Record Time



CB&I specialists, working in cooperation with *Flui Dyne* Engineering Corporation, handled the engineering, fabrication and assembly of this country's first "turn-key" supersonic wind tunnel. Built for Convair Division of General Dynamics Corporation, the intermittent *blow-down* type tunnel is capable of simulating speeds that range from Mach 0.5 to 5 (five times the speed of sound).

This $3,500,000 project for Convair is one of several supersonic test facilities in which the coordinated facilities of CB&I are playing a major role. These same engineering, fabrication and erection services can provide *you* with the benefits of *one source craftsmanship in steel*—with which CB&I has served industry, science and government for almost seven decades. Write our nearest office for a copy of the *Convair Story*.



E62CB

1. **F-106 A Delta Dart,** supersonic all-weather interceptor being manufactured by Convair for the United States Air Force.

2. Sketch shows major components of CB&I-built 3,700 MPH wind tunnel at Convair plant, San Diego, California.

3. Six CB&I-built tanks store air at 600-psi for intermittent blow-down type tunnel.

4. Tunnel "throat" or nozzle is comprised of flexible plates to generate flow from Mach 1.6 to 5—was precision assembled to few thousandth of an inch accuracy.

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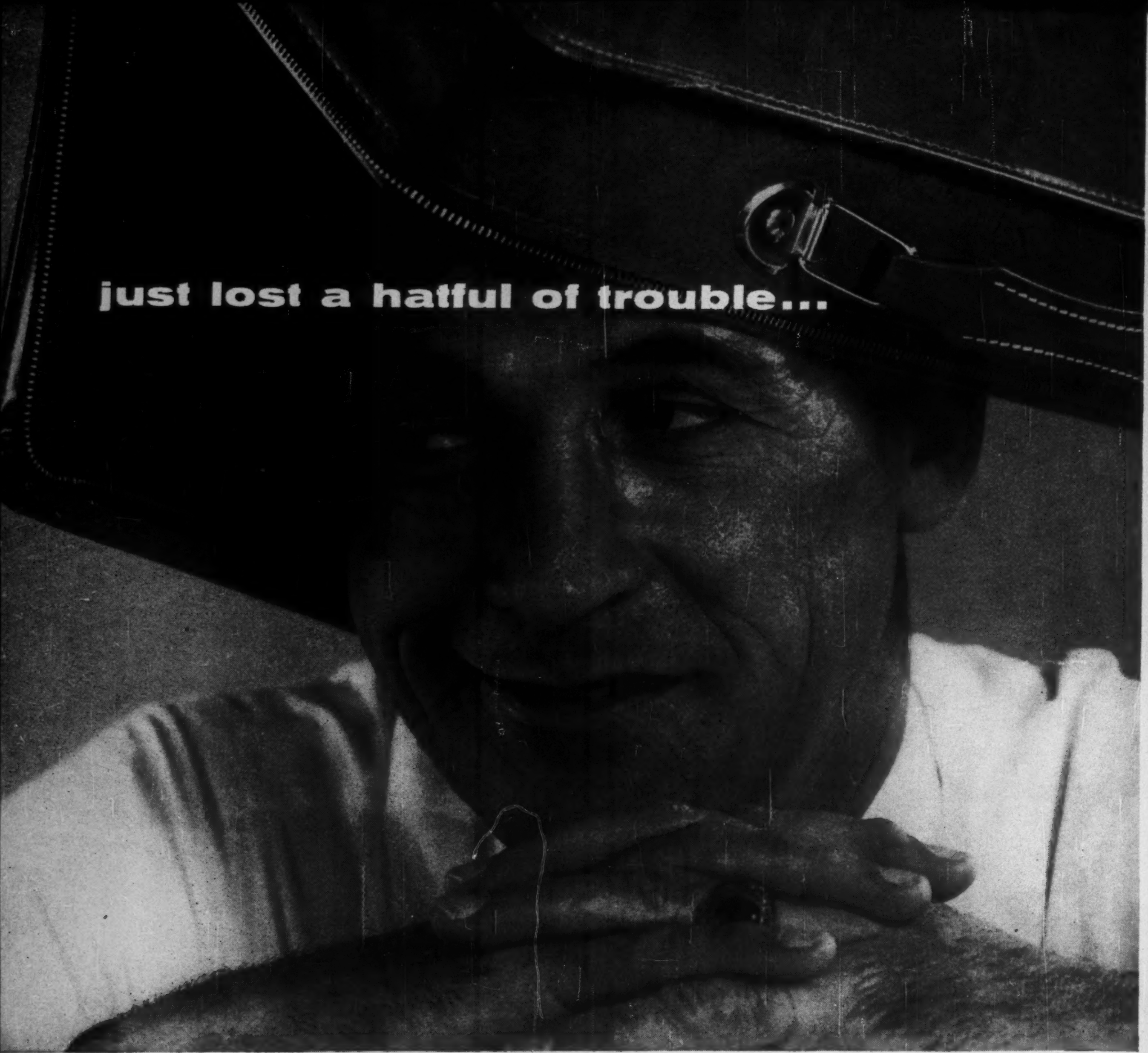
just lost a hatful of trouble...

ONLY ADSCO HAS ALL 3 TYPES OF EXPANSION JOINTS

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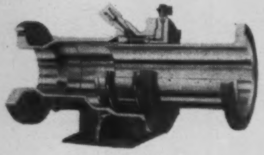
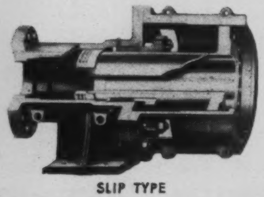


RAM-PAK



SLIP TYPE

". . . to the Adsco man. He was here a minute ago . . . saw our piping problems in Area F and took them all with him. He'll bring 'em back solved next week and then I'll give him the order for the expansion joints."

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World's Oldest and Largest Manufacturer
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ENGINEER

JANUARY · 1960

EJC NEWS BRIEFS

1960 EJC OFFICERS. Elected unanimously by the EJC Board of Directors:
PRESIDENT, Augustus Kinzel, vice-president, Research, Union Carbide and past-president AIME (1958); VICE PRESIDENT, Cecil Boling, president, Dunham-Bush and past-president ASHRAE (1958).

EJC Group to Study Engineering Utilization in the USSR. Utilization of engineers and engineering technicians and their allocation in the industrial complex of the USSR will be the objectives of an EJC mission this year.

The mission is included under the agreement signed by the US and the USSR on Nov. 21, 1959, for co-operation in exchanges in the Scientific, Technical, and Cultural Fields in 1960-61. The project will be closely co-ordinated with a group of the American Association of Junior Colleges that will study educational development of technicians, and will go beyond the engineering education processes which were the subject of a mission by the American Society for Engineering Education in 1958.

Plans are now being discussed to insure an effective study tour and the dissemination of its findings to the engineering profession and the U.S. industry.

Inter-Society Privileges. Many of the engineering societies have had agreements with others to permit exchange of meeting privileges of their memberships. The EJC Committee on Recognition of Specialties has endeavored to obtain more widespread practice of this policy to promote closer co-operation among the various disciplines and encourage broadening of interests and education in other specialties.

The Committee now reports that 15 of the EJC Societies have agreed to extend meeting privileges accorded their own membership to the members of other EJC societies. These are: ASCE, ASME, AWWA, AIEE, ASEE, ASHRAE, AIChE, SAME, AIIE, ASAE, AIPE, LES, ESNE, SCSE, KSPE.

National Engineers Study Under Way. Dr. Harold S. Osborne, noted consulting engineer (retired chief engineer, AT&T; president, AIEE—1942) has accepted the chairmanship of EJC's Engineers Register Committee. The Committee — with representatives from all sectors of the engineering profession — is responsible for the study EJC is undertaking on behalf of the National Science Foundation to determine the desirability, feasibility, and methodology of developing a national register of engineers. Membership of the Committee will be announced shortly by EJC.

Mr. F. Aken (former vice-president of Johns Manville) has been appointed Study Director with offices in the Engineering Societies Building.

NATIONAL AFFAIRS

Engineering Manpower. Degrees and Enrollments. In 1959 engineering colleges awarded 38,162 BS, 4,177 MS, and 713 PhD degrees. The total, 45,636, represents the highest number of degrees since 1951, and an increase of 9% over 1958.

In the meanwhile, however, the engineering enrollment trend is definitely downward. In 1958 the freshman class dropped 11% over the previous year and a further decline occurred in 1959. The projection for degrees in the early 1960's has, therefore, been adjusted down materially from earlier estimates.

Demand. The Engineering Manpower Commission of EJC has just completed its 1959 survey of demand for engineers in industry and government. The findings are that demand in 1959 increased substantially over 1958 and only the large engineering class precluded the development of large supply deficiencies.

Participants in the survey predict rising demand for engineering graduates in the 1960's, at a time when the new supply from our colleges will not be increasing. The implications of the current trends will be analyzed by EMC and published shortly. The 1959 Demand report is available from EMC, 29 West 39 Street, New York 18, N. Y.

Engineering in the National Academy of Sciences. In a move to strengthen the status of engineering and increase participation by engineers, the National Academy of Sciences has elected EJC President-Elect Augustus Kinzel, Chairman of NAS' Division of Engineering and Industrial Research, for a two-year term effective Jan. 1, 1960.

MECHANICAL ENGINEERING PRESENTS HEREWITH — ON AN EXPERIMENTAL BASIS — A CONDENSED VERSION OF A NEWSLETTER COMPILED BY ENGINEERS JOINT COUNCIL ON SUBJECTS OF BROAD INTEREST TO THE ENGINEERING PROFESSION. YOU ARE INVITED TO COMMENT ON THE MERITS OF THIS PROJECT TO EJC, 29 WEST 39 STREET, NEW YORK 18, N. Y.

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ENGINEER

EJC NEWS BRIEFS • NATIONAL AFFAIRS • EDUCATION •

Engineering Representation, NSF Board. EJC will transmit recommendations to the President of the United States and the Director of the National Science Foundation of engineering candidates for appointment in 1960 to NSF's governing body — The National Science Foundation Board. The candidates selected from a canvass of the member societies include: Murrough P. O'Brien, Dean Emeritus, University of California; Eric A. Walker, President, Pennsylvania State University; Augustus B. Kinzel, vice-president, Research, Union Carbide; and Robert H. Roy, Dean of Engineering, The Johns Hopkins University.

The Stamp of an Engineer — Part 2. Since engineering achievements are becoming popular as subjects for postage stamps (ENGINEER No. 2, Nov. 11) it has been suggested that the societies encourage increased recognition of this kind in the U.S. Even more appropriate would be the honoring of outstanding engineers — through the "Famous American" series. The latest stamp in this series honors a physician, Dr. Ephraim McDowell, as a pioneer in abdominal surgery.

Certainly the engineering profession could nominate equally distinguished candidates!

INTERNATIONAL AFFAIRS

Science Attaches and Engineering. Means of co-operating with foreign science attaches in their relations and contacts with the engineering profession and engineering developments in the United States were discussed at a meeting in Washington, D.C., on Dec. 4, 1959.

Under the sponsorship of the EJC International Relations Committee the meeting was attended by Science Attaches of foreign embassies, leaders of the engineering and scientific community including presidents of engineering societies, and officers of the Department of State, led by Dr. Wallace Brode, Science Advisor to the Secretary of State.

Gail Hathaway (past-president, ASCE), Chairman of the Committee on International Relations, presided over an informal program; speakers discussed the organization of the profession and activities of the engineering societies and their joint organizations and services (EJC, ECPD, ESPS, Engineering Index, and Library).

Inter-American Engineering Meetings. The sixth Convention of the Pan American Federation of Engineering Societies (UPADI) will be held in Buenos Aires, Sept. 19-25, 1960. U.S. participation and representation through EJC are being planned by the Committee on International Relations. Announcement of program details will be made in the near future. U. S. engineers are invited to attend and can be recognized through your society represented in EJC.

UPADI is also instrumental in the organization of the first Pan American Conference on Engineering Education, to be held immediately preceding the UPADI convention, Sept. 12-17, 1960, in Buenos Aires. U. S. participation is planned under a co-operative program sponsored by ECPD, ASEE, and EJC. Program details will be announced.

EDUCATION

Training Positions Needed. Nearly 100 American engineering and science students have applied for foreign training positions for the 1960 program under the International Association for the Exchange of Students for Technical Experience (IAESTE). Approximately 200 applications are expected. In order to place these 200 abroad, the United States IAESTE Committee must have an equivalent number of training opportunities available in the U.S. for students from the countries in which the Americans will train, since this is a reciprocal program.

Detailed information concerning the program can be obtained from the United States IAESTE Committee at Engineers Joint Council.

Improved Russian-English Technical Dictionaries Needed. To improve the evaluation of engineering developments in the USSR, there is a need for an accurate unabridged Russian-English dictionary and particularly for dictionaries in major engineering disciplines such as mechanical, civil, electrical, chemical, mining, metallurgical, and petroleum. These are the major findings of a study of a special consultant group on Polytechnic dictionaries established by EJC with a grant from the National Science Foundation.

A full report of the survey and results, completed with the co-operation of the Engineering Societies Library, was submitted to NSF to aid in the determination of national needs and serve as a guide in evaluation requests for support in developing dictionaries of value to the engineering profession.

EJC PUBLICATIONS

Engineers Joint Council. (29 West 39th St., N. Y. 18, N. Y.)
- EJC Annual Report (1958)—No charge.
- Engineering Societies Directory (1959)—$3.50
- Principles of a Sound National Water Policy—25¢
- Policy Statement on Air Pollution and Its Control—The problem and its solution—No charge.
- The Practice of Consulting Engineering—$1.50
- Raising Professional Standards and Improving Employment Conditions for Engineers—No charge.

Engineering Manpower Commission of EJC.
- Professional Income of Engineers—1958 — $3.00
- Salaries and Income of Engineering Teachers—1958 — 25¢
- Demand for Engineers—1958 — No charge.
- Engineering and Science Education—Proceedings of Conference—No charge.
- Trends in Engineering Enrollment—1959—No charge.
- Engineering Graduate Placement Survey—No charge.

MECHANICAL ENGINEERING

VOLUME 82 • NUMBER 1 • JANUARY, 1960

Introducing Walker Cisler

The new President of ASME, the third president of Detroit Edison to attain this office,[1] still has the broadaxe he used for hewing out fence post and fence rail on a small farm when he was a boy. The blade was purchased; but a handle would have been 50¢ more, and Walker Cisler didn't have it. He made his own hickory handle.

Not only does he own the axe, he owns the farm. There is a pattern, here. Walker Lee Cisler is a man who forms strong ties, a man who goes back. Two of the strong influences in his life have been Gradyville and Cornell. Gradyville is a Pennsylvania village where, from early boyhood, he was the man of the house at his mother's place. Today, the place is restored and improved.

Cornell is his Alma Mater, the place where he earned honors as an engineering student after a perceptive high-school principal had recommended he abandon the business course and take science. Today, Cisler is a trustee of Cornell.

This loyalty to places and people whom he has served and who have served him, now imposes burdens which would swamp another man. In the past twenty years he has come to know Washington (the early, critical days of the War Production Board); he has served overseas as a Lt. Colonel—later Colonel—in the Mediterranean and European theatres, rebuilding and operating electric power facilities; as a member of General Eisenhower's staff he was Chief of Public Utilities Section, SHAEF, and later held the same post for the Military Government of Germany. Postwar, as a special consultant to the Government, he gave over-all direction to the electric-power work under the Marshall Plan and succor agencies.

The loyalties pile up. But the thing cuts both ways. In his collection are a French Legion of Honor and Croix de Guerre with Palm, English Order of the British Empire, Netherlands Order of Orange Nassau—Degree of Commander, and Belgian Officier de L'Ordre de Leopold. (His American decorations: The Legion of Merit and the Bronze Star.) A host of friends entertain Mr. and Mrs. Cisler overseas: the royal family of The Netherlands, among other heads of state.

Without the counselling of that high-school principal, Walker Cisler would have gone into the wool business in Montana. He had an uncle who was a wool merchant, and the logic of family connections dictated a business course followed by a career in wool.

But the boy had already been fascinated by machinery. Young as he was, he had a contract with the Post Office Department to deliver mail to the Glenn Mills railroad station some miles away. "It gave me a chance to see the locomotives," he said. "I liked that." It is an indication of the Cisler home environment that when he went away to Cornell his mother took over the mail contract to help pay Walker's expenses at college.

As a college student, Cisler worked summers for the Pennsylvania State Highway Department. Work was not exactly a new experience. "At the age of fourteen," he says, "I could hire out to nearby farms to do the day's work of a grown man. It was rough, but I could do it." He was of medium height, wiry; he played football and ran track.

Late in World War I, he interrupted his college career to serve as a Lieutenant in the artillery. Then, in the fall of 1922, armed with his ME degree, he went to work for Public Service Electric & Gas Company of New Jersey, joining their training program as a cadet.

Editor, J. J. JAKLITSCH, JR.

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[1] The other two: Alex Dow, 1928; James W. Parker, 1942.

ASME President for 1960

Twenty-nine years later the magazine *Business Week*, moving in for a closer look at the new president of Detroit Edison, would report that Walker Cisler was ". . . an improbable executive . . . As a man he's mild, reticent, generally undramatic, and his work is his recreation. He seldom plays golf . . . All his imagination and personality seem to be wrapped up in his business life . . ." Thus, in retrospect, it is not surprising that his two decades with Public Service of New Jersey should appear to have been "uneventful." The record merely states that toward the end, as World War II approached, he had become Assistant General Manager of the Electric Department.

Didn't anything ever happen? Well, there was the occasion back near the beginning, when a huge turbine rotor failed and was loaded on a flatcar for Schenectady—and disappeared. The season of peak load for Public Service loomed ahead. They needed that turbine.

Cisler, still a cadet engineer, was given $50 expense money. His boss said, "Go find that car, Walk, and get it to Schenectady." "Walk" found the car lying dead on a siding a few miles from its starting point. Its bearings had burned, and it had been "drilled out" of the train. There was a strike of railway maintenance men.

Cisler borrowed a jack. He raised the pads off the axles and rubbed the journals and bearings smooth with emery. He bought grease. He persuaded trainmen to move his car, and it rolled—for a few miles. A week later it arrived in Schenectady, a triumph both of sweat and the Cisler genius for winning co-operation.

When Public Service loaned him to the Office of War Utilities in 1941, Cisler had his chance to display what has been called his "strange blend of low pressure and tremendous vision." His job: Supervision of schedules and production of all power equipment, co-ordination of construction of power projects, and allocation of equipment for Lend-Lease and other overseas projects.

Then in 1943, his OWU task completed, he accepted an offer from Detroit Edison to become Chief Engineer of Power Plants. But at the request of the Secretary of War, he was given leave of absence to serve in the Army. Lt. Col. Cisler tackled the job of putting liberated utilities back in operation.

The episode most frequently recounted in the press concerns his restoration of power to liberated Paris. The following account is from articles in *Business Week* and *Fortune*. Through the underground, Cisler learned there would be no fuel left for power when the Germans moved out. But there were hydroelectric installations in the south of France in the hands of resistance forces. There had been transmission lines connecting the hydro plants to Paris.

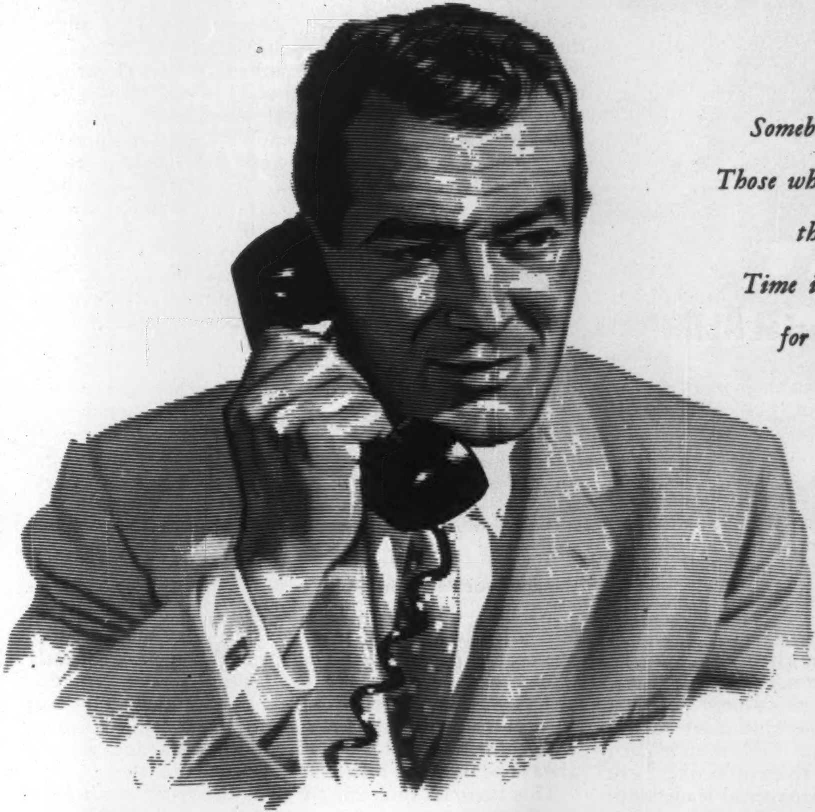
Col. Cisler organized repair teams. Whenever a section of the line fell into Allied hands, a team would move in and fix it. The first Allied troops arrived in Paris toward the end of August, 1944, and by Sept. 6 power was flowing into the city. "The City of Light had light."

After World War II, Walker Cisler took up the job of Chief Engineer of Power Plants for Detroit Edison. He stepped into the midst of an intensive power-expansion program which called for additions to existing facilities and the planning for new generating stations. Since becoming president, December, 1951, he has maintained his company's policy of expansion based on careful forecasts. His company was the first to purchase turbine generators having a capacity exceeding 300 Mv. As a pioneer in atomic development, he led in the organization of the industrial groups which, with Detroit Edison, are engaged in the design and construction of the Enrico Fermi Atomic Power Plant.

Cisler's career can be summed up in quotes from Detroit papers:

"Walker Cisler has hit the trail to Washington, again, to contribute another lobe of his brain to his country . . . The passage of the Atomic Energy Act of 1954 is due in part to the leadership of Walker Cisler . . . He has maintained that only through the dynamic initiative of private industry can the nation reap the untold benefits now latent in atomic energy . . ."

That is the boy from Gradyville and Cornell, the executive from Detroit, who will lead the ASME in 1960. *Fortune* magazine has said of him: "He is the new businessman, one of the administrators of the new capitalism. The tycoon is dead. It is the Cislers who are replacing him."—*M. Barrangon*



Somebody's got to give orders.
Those who do had better have
the talent—and the courage.
Time is running out in the race
for the world's markets.
Needed: Managers
who can manage.

By F. F. Bradshaw

President, Richardson,
Bellows, Henry and Company, Inc.,
New York, N. Y.

Developing Managerial Abilities

In our management-development programs, the climate altered radically after Sputnik rose in the sky. In the past, the American standard of living has been high: We have had two oceans, untapped and unexcelled natural resources, a flexible class structure, a large "common market," and successive waves of European immigration. We have enjoyed the absence of a high defense budget. These factors have been great assets of our past no longer available to us. Efficiency of management will have to substitute for these lost assets of our history.

Today we may be engaging in practices with regard to the management of engineering and the developing of managers which are ineffective and inappropriate. The consequences could be as uncomfortable to us as the consequences that China once suffered in her reliance on ancient practices in choosing leadership. The western nations outstripped her and pushed her around in the process of opening closed doors and developing trade.

What Is a Manager?

A manager is a person who gets work done by other people, with satisfaction to them—work of a high quality, in spite of difficulties and stress. The essential element of this definition is that the work is done by others. The manager's own work is a means to that end.

There is widespread experimental literature to prove that about three fourths of the best managers share certain common characteristics. These characteristics, when spelled out, digested, and interpreted, point to an individual who is emotionally mature and relaxed, not likely to take it out on others, apt to have time for planning and personnel problems. He is accessible to his subordinates and unafraid in the presence of his superiors.

Needless to say, he also knows the work to be managed, at least to some degree, and he has good judgment about who can do what. Because of his judgment of people, accessibility to people, and knowledge of the work, he does not find it hard to make a plan which will be followed by others.

In contrast, the poor manager is busier, does more of the work himself, likes people less, has less time for planning, and is less likely to be followed, respected, and liked. He is less likely to have good communications upward.

We will have to admit, frankly, that we do not know how the managerial characteristics are developed. They

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Contributed by the Management Division and presented at the ASME-AIEE Engineering Management Conference, Los Angeles, Calif., September 17–18, 1959. Condensed from ASME Paper No. 59—Mgt-1.

Developing Managerial Abilities

seem, when studied intensively, to run their roots all the way back to family life and to school life. One prominent educator once remarked that no nation had ever made democracy work that did not have competitive athletics. There is something in the good manager which looks as if it might have been developed by an adolescent experience in teamwork, fair play, and dedication to the job. That seems to say that good managers are already set by the time we get them, and there is not much we can do in management-development programs.

Leadership Does Develop

However, there are many cases in history such as the Jesuit movements, the Pythagorean society of Crotona, Italy, in 559 B.C., the development of new political parties, military movements, and revolutionary forces, which would indicate that young and middle-aged adults, when "seized by dedication to an objective," can in fact increase their capacity for managerial leadership.

What seems to happen in these cases, however, is not so much a once-over-lightly of a course dealing mainly with information, words, figures, and techniques as it is something more nearly akin to what happened to St. Paul in the New Testament. There is a reorganization of the individual scale of values, a re-examination of his operating assumptions, and a change in his over-all philosophy of life. In short, this is new knowledge in depth, as we say, and not merely factual or technical information.

It is probably this kind of managerial development which underlies the technical developments in Russia since the revolution. It was almost certainly this kind of leadership which developed America when, as Robert Frost says, the "best" people all left the country after the American revolution. He then goes on to say that the second-raters who remained developed one of the world's great industrial civilizations. This is the kind of dynamic management that we are face to face with today in the world competition.

Is there anything we can do to improve the managing of technical and scientific work as we face this kind of competition? Summarized briefly, and perhaps dogmatically, here are some of the things we know about individual development.

The Climate for Learning

Three fundamental considerations underlie all good teaching in advanced fields of art, science, and skill:

Individual differences. Each individual has his own special problem in developing the kind of knowledge, judgment, and leadership capacity demanded of management. Probably the major locus of development will be where the individual works on his job, rather than in a class. Although a class may provide information, and perhaps make a slight change in attitudes, it probably cannot actually develop management ability.

Improvement in skill. This requires consistent practice over a long period—with success and reward. Skills may be learned, but will not be used except under these conditions. Again, this suggests that the principal locus of management development will be on the job, because the skills will be learned only when they are tried out and experienced in the individual's own unique job.

Incentive and opportunity. This requires a supportive climate of attitude, policy, and reward. Improvement means change, difference; difference means resistance, and sometimes mistakes. Unless the top leadership of the organization is able to create a climate that will encourage change and permit mistakes, we are likely to get the "organization man" and the static practice. Responsibility for management development lies squarely on the top authority. Only there can the climate be created which will enable mature adults, already with substantial status, to take the risks of learning to be different and better.

Manager—or Performer?

We have long recognized our mistake in making the best salesman a sales manager, the best machine-tool operator a foreman, and so on. We have frequently spoiled a good performer and created a poor manager. Unless we can take the rewards and status symbols that go only to managers, and make them possible to those who contribute technically but do not manage, we will always be likely to make the expensive mistake.

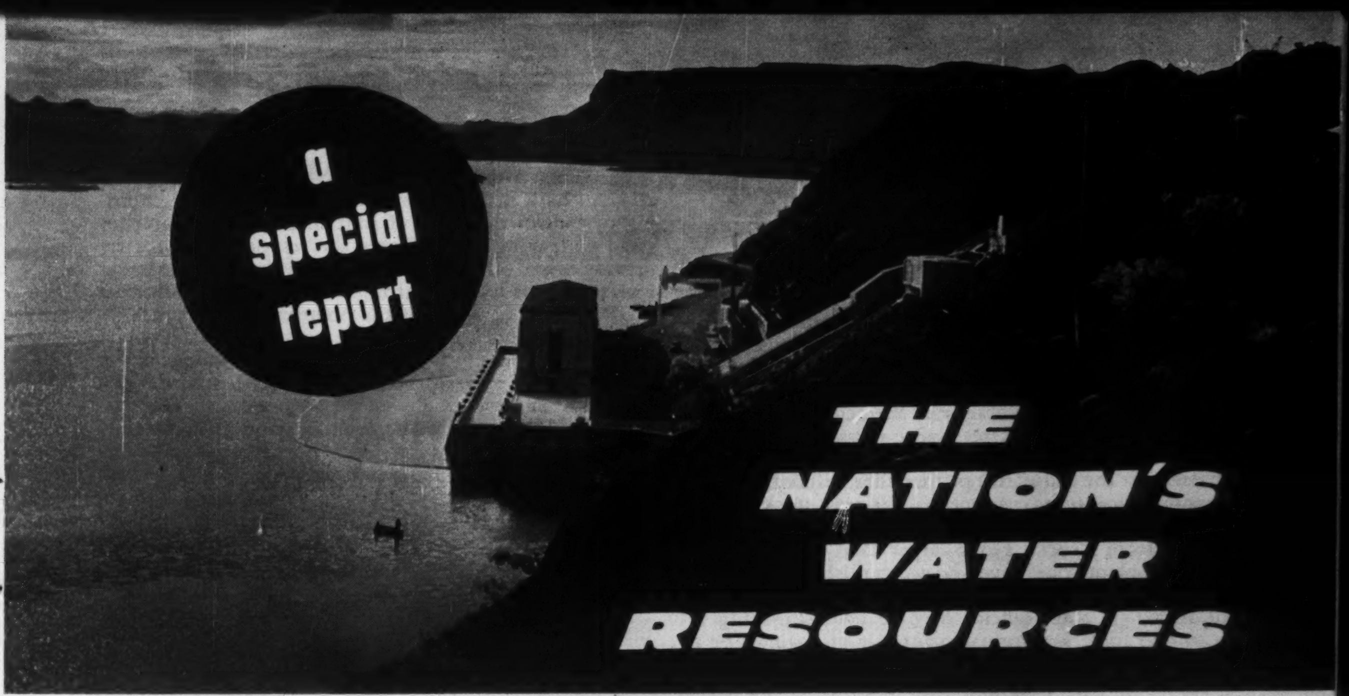
This becomes increasingly so as the speed of scientific development makes it less possible for a man to spend his time both managing the work of others and studying his own technology. It becomes doubly impractical when we realize that one of the jobs of the manager is to facilitate communications between divergent technologies and specialized vocabularies.

There need be little concern about the pay of the manager versus the specialist under his direction. It may be that we will have to continue to pay managers more money to compensate them for dong the less interesting, and in many respects less significant, work. But we must get the manager off the pedestal of authoritative behavior, otherwise his increasingly superficial technical knowledge acts to deteriorate the technical competence of the organization.

Off the Pedestal

We must get him off the pedestal of status and prestige, else the people on the verge of significant contribution in the area of scholarship will be perpetually tempted to accept "promotion" to managerial work. In the technical fields, the manager must be an assistant to his subordinates and must rely on them for specialized technical competence which he can humbly use as he takes the lead in planning, organizing, and evaluating their work.

The world has not had this situation in it before. We have to develop new types of leadership to meet new types of situations. Otherwise, we will find ourselves in the swamp of maladjustment, inadequacy, and retardation if we adhere to ancient concepts of management and manager development.



THE NATION'S WATER RESOURCES

The Technical Development Committee of ASME reports on underdeveloped areas of technology in which technical-society activity will soon be of vital importance, and promotes action to keep engineers on top of the coming problems. At ASME's 1959 Semi-Annual Meeting, the Committee sponsored two technical sessions on the subject of water resources.

The reason for this: In 1955, the Nation's average daily water requirements totaled 220 billion gal, while the total dependable supply amounted to a daily average of 314 billion gal. We now use about 240 billion gal of fresh water a day. In 1980, the daily demand is estimated to reach 597 billion gal, with a predicted average level of dependable supply of 515 billion gal. Thus a major problem confronts industry and the Nation, one which must be solved by the engineering profession.

The five papers, all by leading authorities from industry, research laboratories, and Federal agencies, are here presented in capsule form, briefing ASME members on this coming challenge to mechanical engineers.

ROBERT C. ALLEN[1]

Industrial Water[2]

By E. P. Partridge, Mem. ASME

SOCIETY, as represented by government at the Federal, state, and local levels, has been vitally interested in water. This interest has amounted to the expenditure by Federal agencies of an average of $1 billion per year over the past decade for development of water resources. Attention has been concentrated, however, chiefly on navigation and control of floods, generation of power, creating more farmland by irrigation, reducing pollution, assisting conservation, and recreation. On the other hand, society has told industry what it tells the cities: "Get your water where you can."

The Claim on Water

Water for domestic and municipal use enjoys top priority; water for industry is a poor third to agriculture where water is scarce. Indeed, when society thinks at all about industrial water, it reprimands industry for pollution rather than asking about its needs. Perhaps industry has failed to explain its side of the story to the rest of society.

Much of industry has always procured its own water directly from surface or ground supplies, accepting the verdict from society that this was the proper procedure. While Federal effort was being expended on water control, conservation, and use for other purposes, industry continued to think and act in the pattern of finding locally at minimum cost the water needed for each new plant. Almost resolutely, it avoided co-ordinated thinking at a national or state level.

Replies by 3057 plants to a 1950 questionnaire supported the thesis that industry a decade ago was not seriously interested in water resources. Of the industrialists responding, 40 per cent did not know whether their local sources of industrial water for all plants in their area could supply only a few or an unlimited number of additional plants. Very few knew of any government or private activities, either planned or in operation, which might affect the water source for their area.

More and more of the water which industry will need will be coming in the future from storage in surface or underground reservoirs created primarily by Federal agencies in collaboration with states. In the allocation of water from such reservoirs, it seems almost inevitable that society will invoke the concept of beneficial use.

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[1] Chairman of ASME Board on Technology, and Chairman of the Technical Development Committee. Mr. Allen is Director of Mechanical Engineering, Industries Group, Allis-Chalmers Maufacturing Company, Milwaukee, Wis.

[2] Condensed from "Industrial Water: Use, Reuse, Misuse?" by Everett P. Partridge, Hall Laboratories Division, Hagan Chemicals and Controls, Inc., Pittsburgh, Pa. ASME Paper No. 59—SA-60.

Based on five papers contributed by the Technical Development Committee and presented at the Semi-Annual Meeting, St. Louis, Mo., June 14–18, 1959, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Few cities and few industrial plants have been so altruistic as to add voluntarily to their costs of operation by cleaning up their wastes before pressure was applied by society. To the city this means increased taxes to its citizens; to the industrial plant either reduced profit or increased prices to its customers. Citizens, stockholders, and customers have all been known to rebel. Only by pressure from a social group larger than the city or the industrial plant could much be accomplished.

Even at the state level it has not been easy to cope with pollution. A state official may be understandably reluctant to force a marginal plant out of business or to push new industries into the hands of some more liberal state or to impede the political progress of himself or his superiors. By default, some of the responsibility for making us all do what we must logically agree should be done has been passed along into the hands of the Federal government.

Disposal of Effluents

When a plant has to begin to worry about disposing of its effluents, it is likely to undergo an unexpected revolution in its thinking. Its past practice of flushing away its unwanted wastes has conditioned everyone to use water freely, if not extravagantly. But now an effort must be made to contain each pollutant in the smallest practical amount of water, to reuse lightly polluted water, to pick up additional pollution in another plant operation, and to combine effluent streams where one will help to treat the other in the new facilities for handling waste.

What a tremendous effect this can have is well illustrated by the plant of Kaiser Steel Company at Fontana, Calif., which was designed to swallow its own wastes. In southern California, water is scarce and hard to dispose of when polluted. Accordingly, the Fontana plant was so designed that it withdraws only from 1200 to 1400 gals of water per ton of steel.

How does Fontana manage to operate with less than 2.5 per cent of the water used on the average by the steel industry?

1 Cooling water is recirculated over towers instead of being used once-through.

2 Blowdown from cooling systems is reused repeatedly in successive systems.

3 Effluent from the plant sewage-disposal operation enters the cooling cycle.

4 Cooling water which has accumulated the heaviest load of pollution is used for quenching slag, where it is evaporated.

All this is not accomplished without cost. Both capital investment in the water system and pumping costs have been estimated at about three times the values for a once-through system. But the plant has virtually no waste water and can condition its recirculating water for control of scale, corrosion, and slime to minimize maintenance.

Through government at the Federal and state levels, all of us have made a sound economic decision in choosing to control the entry of contaminants into water instead of leaving to each user the responsibility for removing what others previously have dumped. Almost always it costs less to control pollution concentrated in a small amount of water at the point of origin than after it has been diluted.

Keeping more of the runoff where we can use it and reuse it on its way to the oceans is another activity in which all industry could well take a more active interest. In every river basin in the country we shall ultimately need to store more water, if not in reservoirs behind dams, then underground wherever permeable strata can be charged or recharged. In the development of plans for storage of water, who has a stronger interest than the industries which might need to use this water? They should be participating in the planning by government agencies.

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Water Management[3]

By K. S. Watson

It is more natural for industry to use water properly than to be wasteful. The cost-reduction and profit motives dictate that sound and proper usage be made of all components contributing to a final product. More than $2 million per year is being saved in the General Electric Compnay each year by water management.

A water-management program should be concerned with encouraging each plant to:

1 Make sure it is using the best source of water available from the quantity, quality, and cost standpoint.

2 Be sure that necessary portions of the water are softened, deionized, or otherwise conditioned where justified to tailor them to special plant uses.

3 Practice the conservation of water and its recirculation and reuse in all cases where action is economical.

4 Define the plant-waste problem and introduce all within-the-plant, short-of-treatment steps which are consistent with economy to correct the problem.

5 Provide waste treatment where the character of the remaining wastes and the receiving stream of sewer requires this action. This is a good citizenship step on the part of the plant to promote the general welfare by protecting the water resources of the community.

A point which should be stressed is the fact that nothing of consequence will be done about water management until someone is assigned responsibility for this area of activity. If the man assigned to the field has had previous water and industrial-waste experience, his job will be easier and results will be more immediate. There need be no worry about this job being of a temporary nature for a big water user.

Waste Control

The fundamental step in soundly handling the industrial-wastes problem from a plant is to do a proper job on minimum water consumption. This will reduce the size of the waste-treatment plant, its cost, and the cost of operating such facilities. Thus it can be seen that the control of the waste problem is another justification for water management in industry.

In General Electric the waste-control program consists of five phases:

1 Determining whether a pollution problem of consequence exists and defining that problem. Where a problem appears to exist, a survey to determine the quantity of wastes being discharged and their characteristics will be made by plant personnel. This survey will involve gaging the flow of the effluent as well as sampling and analyzing the waste over a sufficient period of time to determine what pollution load it carries.

2 Taking all economical steps short of treatment to reduce the pollution load. In this phase the use of care, good housekeeping, recovery, segregation, conservation, process change, and repiping will be exhausted. This phase will be prosecuted to the maximum extent, because in most cases it represents the simplest and cheapest means of coping with the problem.

3 Designing, constructing, and operating the waste-treatment units to correct the problem. Consulting-engineer aid will often be obtained in designing treatment facilities.

4 Promulgating an educational program for company personnel. In this program the importance of pollution control will be covered. All the points already mentioned concerning the reduction of the problem to a minimum will also be stressed. This phase will acquaint plant personnel withthe part which they must play in reducing stream pollution.

5 Carrying out a public-relations program through the preparation of appropriate technical and newspaper articles to indicate to everyone that General Electric is being a good corporate citizen in this field.

Magnitude of the Operation

Some 30 waste-treatment plants are at present in operation in General Electric. Three additional plants are now in the process of having such treatment facilities designed.

One of the major waste problems in the company is the treatment of metal-finishing wastes. Some of the treatment plants treat the wastes for discharge into the surface streams. In other plants the wastes are pretreated to permit their acceptance in a municipal sewer system.

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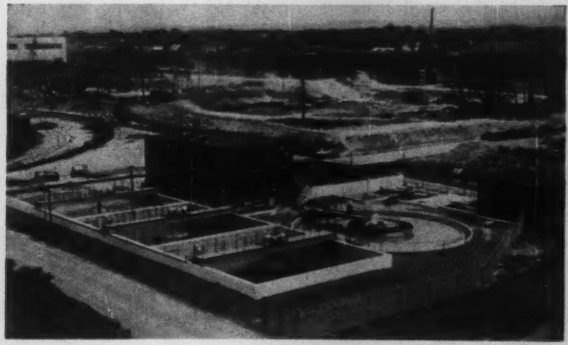
[3] Condensed from "Water Management in Industry," by K. S. Watson, Consultant, Water Management and Waste Control, General Electric Company, Schenectady, N. Y. ASME Paper No. 59—SA-57.

The waste-treatment facilities at General Electric's Appliance Park plant in Louisville. Cyanides, chromium, and acid-alkali wastes are given separate treatment, then discharged into the sewage system.

The General Electric waste-treatment facilities at Erie. The problem is similar to that at Louisville, but the Erie plant does a more complete treatment job so that the effluent can be discharged into Lake Erie.



a special report

Ground Water[4]

By J. G. Ferris

Reflecting an early orientation to waterborne commerce and the obvious advantages of a nearby water supply and a nearby drainageway for waste disposal, most large water-using industries and most large cities are located on stream banks or lake shores, and they are dependent upon surface sources for water supply. However, ground water is used by two out of three communities and by three out of four industry-owned water systems.

Storage

Ground-water storage exceeds by far the aggregate storage of all artificial and natural reservoirs in the U. S., including the Great Lakes. For an example on a smaller scale, a ground-water reservoir having a rock porosity of 20 per cent and an area equal to only a 50-mile square, would contain slightly more water than Lake Mead for each 100 ft of saturated thickness. A saturated thickness of 300 ft would represent storage equal to the aggregate capacity of the Nation's four largest man-made reservoirs (Lake Mead, Fort Peck, Garrison, and Oahe).

The vast ground-water reserve is the capital that sustains the continuing outflow of streams and lakes during the prolonged periods which follow the relatively small number of runoff-producing rains each year. Of course, the relation between ground-water reservoir and stream is one of mutual interdependence: Much of the replenishment to the ground-water reservoir occurs through natural salvage of the stream's floodwaters. As resource development intensifies, the oneness of water will become recognized more generally. Interception by wells of ground water enroute to a stream is just as real a diversion as if the water had been withdrawn from the stream. A diversion from a stream that replenishes a ground-water reservoir is as real a diversion of underground water as the discharge through a well or spring.

Because of the large storage capacity, the large frictional resistance to flow, and the vast dimensions of ground-water reservoirs, the full consequences of man's withdrawal of water or injection of wastes may not become evident for decades or even centuries. Resource development by trial and error may prove to be a costly gamble, in which a desert becomes a garden for a time, but some future generation sees it go back to drifting sands.

Quantitative Study

The principles governing the origin, occurrence, and motion of underground water are not generally known, and little is available in the way of formalized training, and not a great deal in the form of text or reference works on ground-water hydrology.

The first real breakthrough in development of quantitative methodology was accomplished by drawing upon an analogy between the conduction of heat in a slab and the percolation of ground water through a rock formation. Much of the mechanical-engineer's library of heat-conduction methodology has been translated to its ground-water equivalent, and this gives the new science a running start.

Although quantitative study of the Nation's water resources has been expanding, its growth has not kept pace with development needs. As the gap between evaluation and utilization widens, and the roots of economic entrenchment dig deeper, the jungle of water-use conflicts becomes more entangled, and the flowering of remedial proposals becomes more exotic.

Each resource development is a diversion of the hydrologic flow system that must be balanced, ultimately, by reducing the prior draft of other users—whether it be man, nature, or both. As this becomes more generally recognized, questions will arise as to relative need, priority of claim, efficiency of utilization, and relative value of different water uses.

Some of the publicity given to conversion of fresh water from the sea gives investigators in this field a problem in keeping the record straight. It has been pointed out by Jenkins that the prospective cost for desalting sea water will be several times greater than is now paid by many industries for fresh water from natural sources. One significant product of the study of saline-water conversion is realization of the true value of fresh water in terms of the cost of replacing it.

As pointed out by Nace, the principal avenues to water for the future are: Greater efficiency of utilization, improved quantitative evaluation of hydrologic regimens, and scientific management. The complexity and vast proportions of the task ahead require not merely your support but your active participation in both conservation and management of the resource.

Planning by your Technical Development Committee of this symposium on "The Nation's Water Resources" reflects perception and foresight.

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[4] Condensed from "Water Resources in Industry's Future," by John G. Ferris, Hydraulic Engineer, Ground Water Branch, U. S. Geological Survey, Washington, D. C.

Water Wells[5]

By Paul Weaver

Production of water from wells in the U. S. in 1955 was 46 billion gal per day, and about 10 billion gal per day was for industrial plants which had their own supply.

Most of the underground water supplied to these plants is so-called general-purpose water, of quality for domestic use, but we shall see more and more use of mineralized water in areas where general-purpose water from the underground is in short supply. Such waters are likely to be more corrosive to equipment, even equipment inside the well.

Pressure maintenance in oil fields is frequently accomplished with such mineralized underground water because it is more compatible with the water in the oil-bearing rocks.

The new technique of injection of surface water into the underground through wells will be handled satisfactorily only with special filters prior to injection.

Finally, there is the use of wells for injection underground of plant effluents which are unsuitable for other disposal.

It is poor engineering generally to convert a well from one use to another, although there have been successes in the use of a pair of similarly constructed wells as part of a heat-pump installation. There, the circulation is a closed system, and most of the plugging problem is absent.

A Mechanical-Engineering Problem

The equipment to drill wells and to insert pumps in the wells belongs in the realm of mechanical engineering. Equally important is maintenance, which is so largely disregarded until a failure occurs.

Two principal methods are used for the drilling of wells for capacities in excess of 150 gal per min. They are the cable-tool, or spudder, and the rotary. The cable-tool is generally used in a series of hard rocks; the rotary where the walls of the hole are soft and liable to cave before the pipe can be inserted.

The location of large-yielding wells is usually on the recommendation of a geologist and hydrologist, who also are consulted if there are several potential aquifers (as porous rocks yielding water are called).

In the completion of a well after drilling, there are usually inserted three columns of pipe: The casing, from the surface to just above the aquifer; the liner, extending into the casing and through the aquifer (there are holes in the liner for water to enter the well, and the outside may be wrapped with wire, called a screen, so that sand does not enter); the pump column, which is within the casing and above the liner, and deep enough in the water to give submergence for the pump or airjet which lifts the water to the surface.

The choice of the aquifer to be produced through a well should be studied to avoid possibility of contamination from quarries, septic tanks, and river channels intersecting the aquifer nearby. The demonstration that 20,000 out of 60,000 water wells in the Milwaukee district have thus been contaminated from shallow aquifers is the most important case of this kind. Regular periodic testing is essential.

Surface Subsidence

Aquifers in unconsolidated formations should not be produced at high rates per well, or per district, because of hazard of surface subsidence. The precautions necessary can be evaluated by consolidation measurements of subsurface samples between the surface and the aquifer.

There are factors to be considered when more than one aquifer is produced through a single well; and there are completions of wells in fine sand, where so-called gravel pack is placed around the lines outside the screen.

There are the problems of distribution of the water in those cases where there is a dual supply from different aquifers, or from an aquifer and a surface source. Two waters may each hold minerals in solution, but a mixture may cause precipitation, especially as temperature changes are introduced. In these cases the mechanical engineer may call in the chemists. But the other problems are basically within his field.

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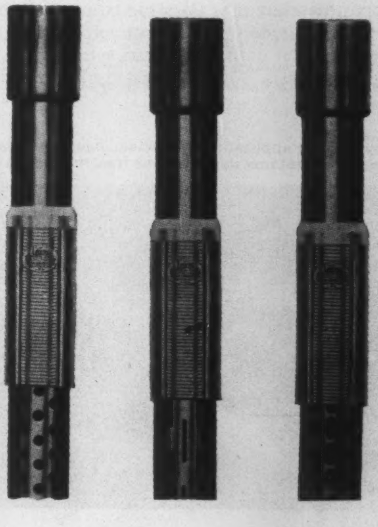

Corrosion is a problem in the metals of screen and pipe. Types of screen assemblies shown are: Plain drilled; slotted pipe; milled groove.

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[5] Condensed from "Water-Well Construction," by Paul Weaver, Professor of Geology and Geophysics, Texas Agricultural & Mechanical College, College Station, Texas.

a special report

Creating Storage[6]

By G. H. Higgins

The Plowshare Program has broad, nonspecific aims which may be stated as "the industrial and public utilization of nuclear explosives." Of particular interest to this meeting is the creation of harbors and water-storage basins through nuclear explosion

At the Lawrence Radiation Laboratory in Livermore, Calif., where much of the Plowshare work is being carried out, there are physicists, chemists, and mechanical engineers familiar with the problems of building, working with, and controlling nuclear explosives. There are not many hydrologists, geologists, or mining engineers to guide the application phases of the nuclear explosives, so that consultation with people from the various universities, industrial organizations, and professional societies is heavily relied upon and continually sought.

The Nuclear Explosion

The energy released during a nuclear explosion is partitioned, just as in chemical explosions, between heat and mechanical work. In addition to these forms of energy, there are residual or excess neutrons which may be utilized for the production of isotopes, and in general the available quantities of work and energy are very large.

Some of our original concepts have been modified or even dropped altogether. For instance, when the first excavation projects were proposed it was assumed that the radioactivity would necessarily be released to the atmosphere. The increased fallout, even though minimized by the use of explosives with the highest possible fusion-to-fission-energy ratio, would simply have been part of the price which would be paid for additional harbor facilities.

This does not appear to be necessary in view of the Neptune experience. Approximately 1 or 2 per cent of the radioactivity escaped during that explosion, yet the crater produced was larger on a per-kiloton basis than that produced by either the "U" or "S" shots. It also appears now that it is possible to predict the containment depth accurately, and that explosions deeper than 450 times the cube root of the energy in kilotons will be contained regardless of the nature of the country rock or overburden with the possible exception of the carbonate rocks.

It would appear also that some of our original ideas about aquifer development, especially water storage, were not well founded on a cost basis, since the volume of direct storage produced by explosions as large as one megaton is small compared to natural storage areas.

The AEC has announced charges associated with nuclear explosions. These charges include the explosive, firing, and conducting safety studies to insure the public well-being. They are to be associated with one or a few explosions at a particular site and substantial reduction in charges might be obtained with multiple firing at the same site. The charge for a few kilotons would be $500,000; a few tens of kilotons $750,000; and a few megatons $1 million. These charges do not include drilling holes or digging shafts to emplace the explosive.

The Cost Figures

Based on experience gained from the tuff at the Nevada Test Site, and coral and alluvium at other places, these charges can be translated into charge per yd of excavation. The range is between $0.90 per yd for a few kiloton explosion, and $0.03 per yd for a few megaton explosion. We believe that the thermal efficiencies and phenomenology in certain other media, such as salt, will be such that the charges per million Btu of recoverable heat will range between $25 and $0.05, or the charges per mole of excess neutrons will range between $250,000 and $500.

It should be emphasized that the amount of broken rock or percentage of total energy which appears as heat depends on the medium, and at the present time the exact nature and degree of dependence are unknown. However, it would appear that the nuclear explosives will produce certain large-scale effects less expensively than conventional explosives or reactors by a factor of ten or a hundred. It should also be possible to recover two or more values from a single detonation. Thus both heat and isotopes could be produced with a single detonation, and the charges could be proportioned acacordingly.

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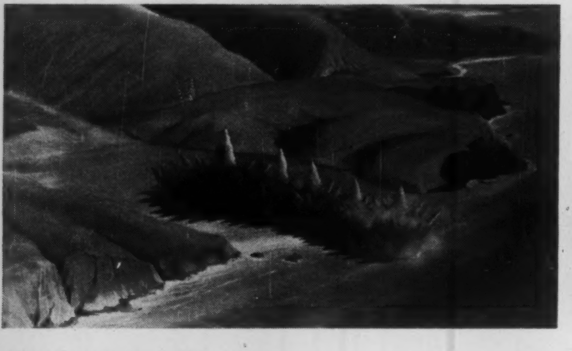
[6] Condensed from "Plowshare Program," by Gary H. Higgins, Nuclear Chemist, Lawrence Radiation Laboratory, University of California, Livermore, Calif.



One of the many possible applications of nuclear explosives, part of the Plowshare Program: Simultaneous explosions fired to produce a harbor

Here is how the harbor would look, after its formation by simultaneous nuclear explosions. They'll also serve to produce water-storage basins.

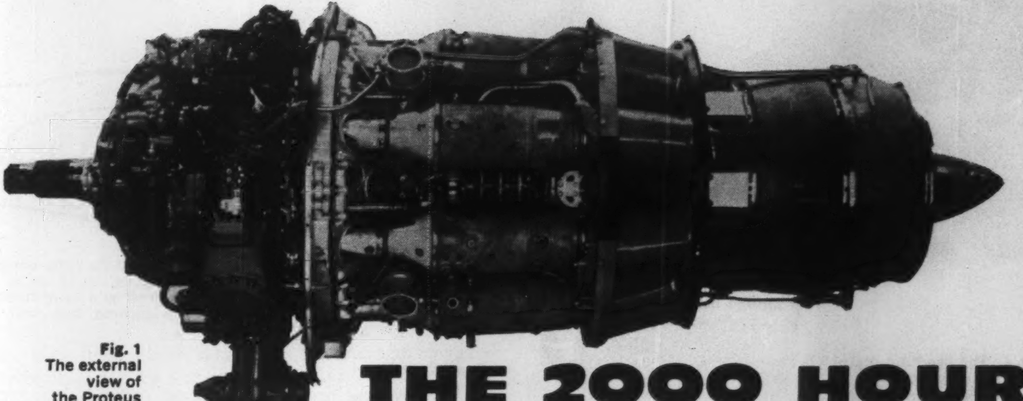


Fig. 1 The external view of the Proteus engine

THE 2000 HOUR Proteus Turboprop

By P. F. Green, Assistant Chief Engineer, Bristol Aero-Engines Limited, Filton, Bristol, England

Every new engine has lessons to teach. Here are lessons learned on the Proteus as Bristol engineers developed it from an overhaul life of 500 hr to the present 2000 hr.

In less than two years of operation the Bristol Proteus 705 engine's overhaul life increased—at a rate which is unrivaled—from 500 hr to 2000 hr, equal to that of any aircraft engine in the world. Matching this is the the reliability of the engine in service. The average feathering rate is one per 5000 hr—less than one third of the featherings on other modern aircraft.

The Proteus engine, Fig. 1, powers the Bristol Britannia which is the largest, fastest, and longest-range turboprop airliner in civil use. The Britannia, Fig. 2, started regular passenger service at the beginning of 1957 and is now in world-wide use with operators who include British Overseas Airways Corporation, Canadian Pacific, El Al, Aeronaves de Mexico, and Cubana.

Description of the Engine

The internal layout of the Proteus is shown in Fig. 3. The engine has a 7.2:1 ratio compressor, consisting of 12 axial stages, followed by a centrifugal stage. The first two of the turbine's four stages drive the compressor and the other two drive a 16-ft four-bladed propeller through an 11.6:1 reduction gear. The engine employs the free-turbine principle; that is, there is no mechanical connection between the propeller-turbine system and the compressor-turbine system.

The complete power plant is double-skinned in the forward portion to provide an annulus around the engine, forming the air-intake passage. This is carefully proportioned to give a high intake efficiency.

The first batch of Britannias was equipped with the Proteus 705, rated at 3890 ehp. Later aircraft have Proteus 755 series engines, which feature mechanical and aerodynamic improvements to give greater power and

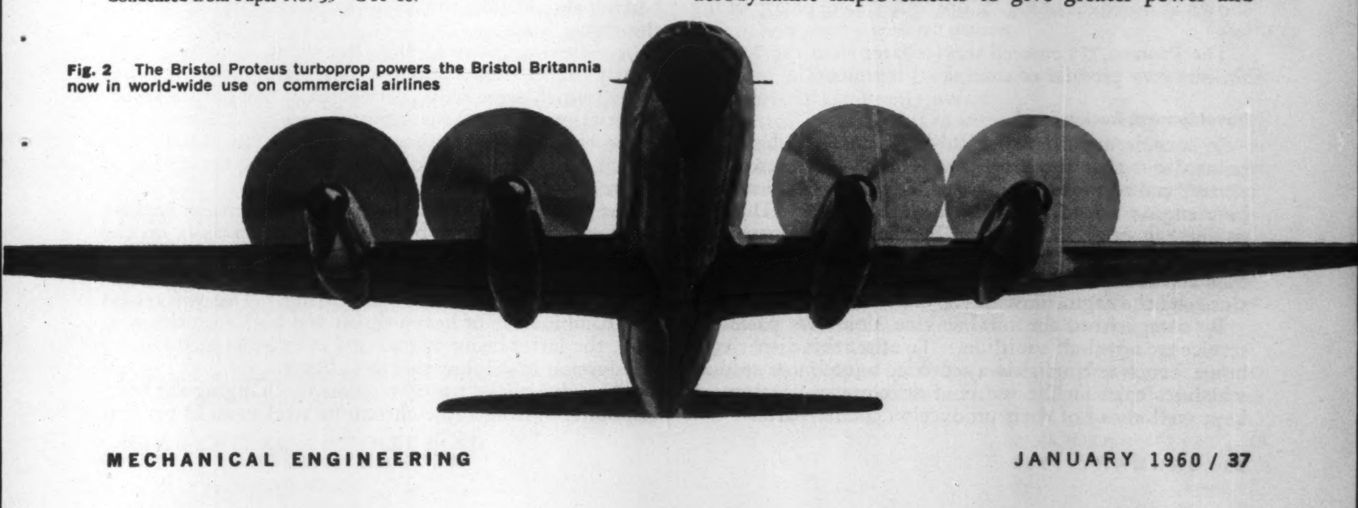


Fig. 2 The Bristol Proteus turboprop powers the Bristol Britannia now in world-wide use on commercial airlines

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Contributed by the Gas Turbine Power Division and presented at the Gas Turbine Power Conference and Exhibit, Cincinnati, Ohio, March 8–11, 1959, of The American Society of Mechanical Engineers. Condensed from Paper No. 59—GTP-10.

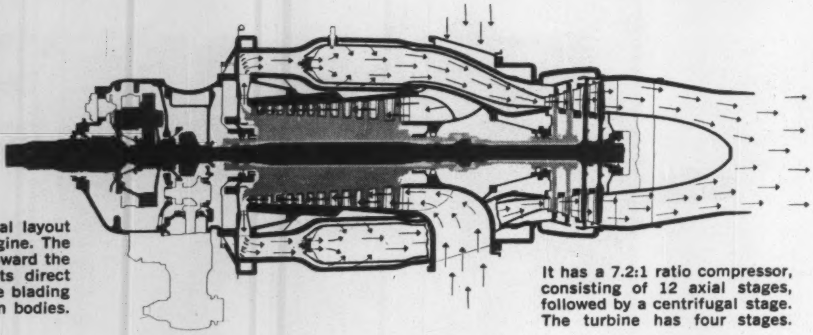
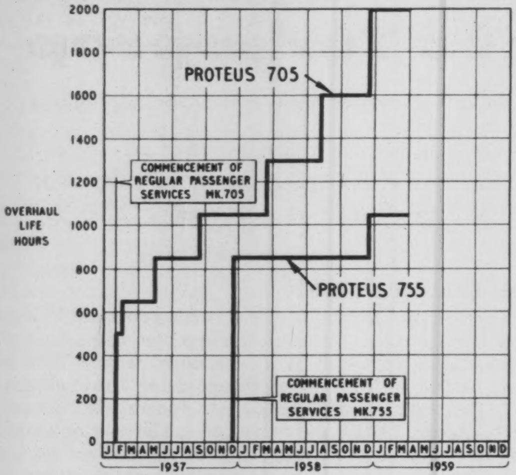


Fig. 3 The internal layout of the Proteus engine. The air intake is toward the rear and prevents direct impact on the blading from foreign bodies.

It has a 7.2:1 ratio compressor, consisting of 12 axial stages, followed by a centrifugal stage. The turbine has four stages.

Fig. 4 The overhaul life of the Proteus has been extended from 500 to 2000 hr in less than two years



better economy. They carry 136 passengers, have a maximum speed of 405 mph, and a maximum still-air range of 5500 nautical miles. The original 755 develops 4160 ehp and the current production model 4400 ehp.

The condition of the engines at 2000 hr, Fig. 4, shows that further considerable extensions of overhaul life are possible. A set of flame tubes, the hottest components in the engine and those which suffer most in turbine engines, shown at overhaul in Fig. 5, obviously have plenty of life left.

The Proteus 755 entered service later than the 705 but shows every promise of similar achievements.

Development Background

In considering this overhaul-life record, it should be pointed out that the Proteus was subjected to more extensive and rigorous testing than any other previous turbine engine before it entered airline service. The first engine ran early in 1952 and by the start of passenger service in 1957, 40,000 bench hours and flight hours had been accumulated. Intensive development has continued since and the engine now has 60,000 hr.

By comparison, the total engine hours in passenger service are now half a million. To offset this disparity in hours, bench testing is always carried out to more arduous schedules than airline use, and development ratings are kept well ahead of their production counterparts.

Free Turbine

The free-turbine configuration contributes greatly to Proteus safety. The propeller is coupled only to the rear turbine, which has no mechanical connection to the compressor. Hence in the event of power failure in flight, the propeller does not have to turn the compressor and the resulting drag is negligible, so that the pilot can feather safely at his leisure.

Compressor Blading

The major component most exposed to damage in any turbine engine is the compressor blading. On the Proteus this is protected from foreign bodies first by the propeller and then by the reverse-flow intake layout, which prevents any direct impact on the blading. The blades themselves are steel throughout and showed little damage when a $^1/_4$-in. bolt passed through them on the test bench, Fig. 6. By comparison, an early compressor of another type had aluminum blades until a small nut entered, Fig. 7.

Further evidence of the toughness of the blading was provided by tests carried out as part of the engine-certification program. Ice cubes and a 4-lb bird were dropped into the intake with the engine running at maximum power. In both cases the engine ran on unharmed.

Bearings

The outstanding overhaul life of the Proteus was not achieved without trouble. The first major problem was occasional wear of the compressor rear roller bearing. This was used in conjunction with a ball thrust bearing, as shown in Fig. 8, the intention being that the roller bearing should take the radial loads and the ball bearing the thrust loads.

Investigation showed that the thrust load was sufficiently high to enable the ball bearing to carry the radial loads, which were only the weight of compressor rotor, via friction at the thrust-housing face. As a result, the roller bearing could run with little or no radial load, which bearing rig tests had shown was the cause of severe skidding and wear.

The problem was solved by removing the roller bearing and locating the rotor both radially and axially on the ball bearing, Fig. 8.

Concurrently with this trouble, evidence of track breakup began to appear on the ball bearing. This was traced to a combination of heavy thrust and high race temperature, the latter being aggravated at extreme altitudes by a reduction in oil flow due to chilling.

These difficulties were overcome by changing the bearing material from a low-chromium steel to an 18 per cent

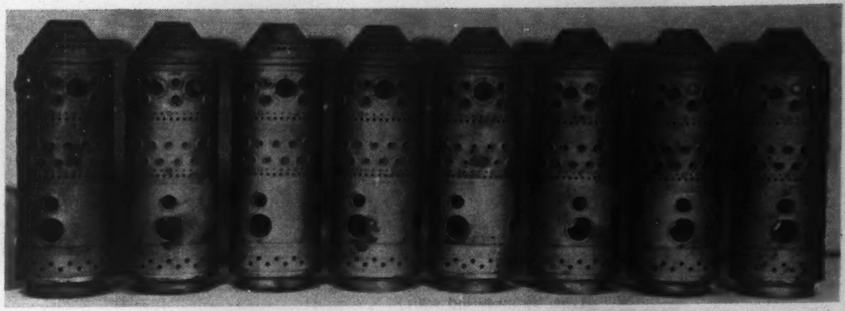


Fig. 5 Flame tubes obviously have plenty of life left even after 2000 hr of service, although they are the hottest components in the engine

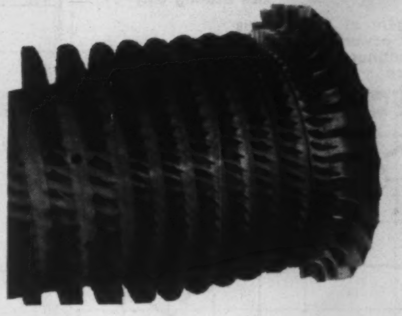


Fig. 6 The rugged steel blades of the compressor were harmed very little when a ¼-in. bolt passed through them on the test bench

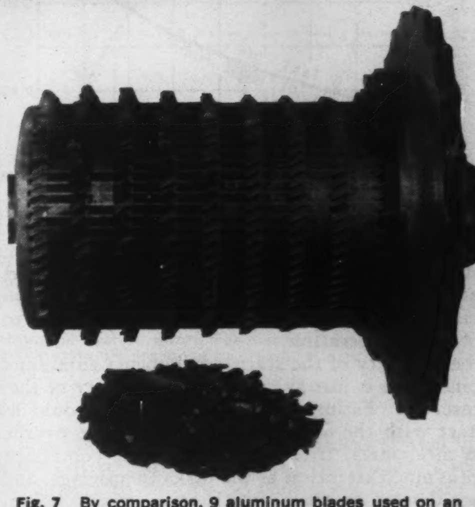


Fig. 7 By comparison, 9 aluminum blades used on an early compressor of another type were severely damaged when a small nut entered

tungsten tool steel which retains its hardness at elevated temperatures, reducing the bearing thrust by altering the compressor high-pressure-seal diameter, and greatly increasing the bearing oil flow.

It may be interesting to note that all Bristol turbine-engine main bearings have steel cages to provide maximum fatigue strength, since a bearing-cage failure can have just as serious consequences as a ball or track failure. The cages are given a special surface treatment to enable them to hold the oil film essential for lubrication.

Bearing Safety

On any engine it is almost impossible to eliminate entirely occasional random bearing failures and it is most important to establish that failure of any bearing will not lead to a dangerous situation. During the Proteus development, failures of all the main bearings have been reproduced, either accidentally or deliberately, and have shown that in all cases the pilot's instruments will give him adequate warning of the failure long before a more serious state of affairs can develop. Because of the high frequency, the roughness of a turbine engine resulting from bearing failure is not transmitted to the cockpit, and other indications such as change in rpm, jet-pipe temperature, power, or handling are necessary.

Turbine Blades

Early in service, isolated first-stage turbine blades broke at about mid-height after short lives. These were difficult for the pilot to detect, because the rugged construction of the engine enabled the broken piece to pass through the rear three stages of the turbine without damage.

Investigation showed that the loss of a blade produced a small change in both jet-pipe temperature and torquemeter pressure which could be used to detect this trouble, and a bulletin was issued to the pilots.

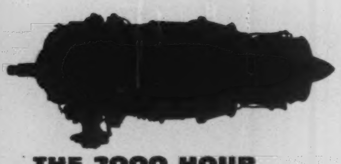
The cause of the failure was soon traced to an additional heat-treatment which a material supplier had added, to assist extrusion of Nimonic 90, without the company's knowledge. Unfortunately, this caused appreciable grain growth, which led in some cases to blade failure. Nimonic 100 blades had already been introduced on the higher-rated Proteus 755 and eventually all 705 engines were fitted with these blades. Nimonic 100 has a temperature advantage of 40/50 deg C over Nimonic 90 and has paid handsome dividends.

Turbine Integrity

Turbine disks, with their high rotational energy, could have lethal results if they failed. This is a problem of which all engine manufacturers and airworthiness authorities are keenly aware.

Bristol's approach is to keep the disk stresses to modest values. This results in disks of generous proportions, which are free of the vibrational modes which can be produced in slender disks by combustion irregularities. The first two turbine stages also have austenitic-steel disks. Austenitic steel has lower mechanical properties than a ferritic steel at normal temperatures, which necessitates some increase in disk weight, but it maintains properties at the high temperatures which might result from an interruption of the cooling-air feed to the disks, and hence provides a large safety margin.

On the type of disk described, cyclic thermal stresses are the most important factor. To keep development



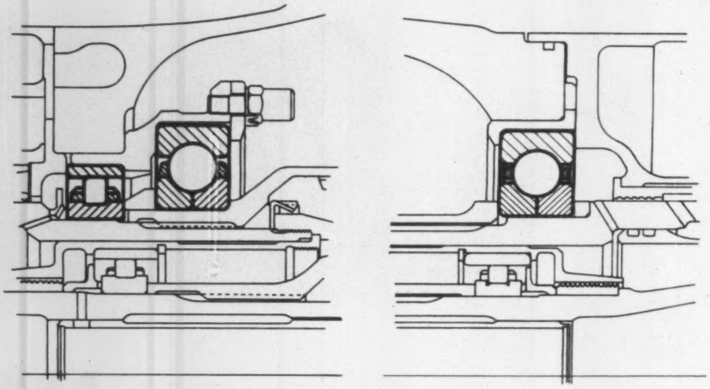
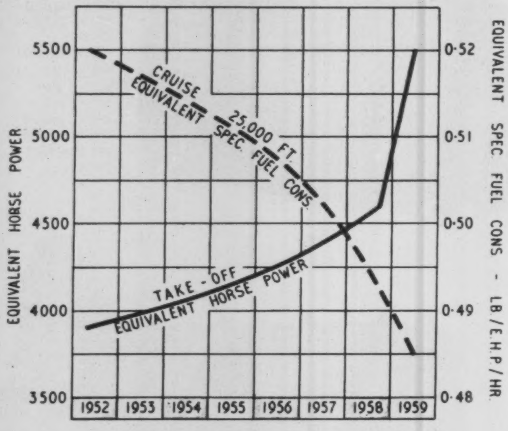


Fig. 8 The compressor thrust-bearing assembly, **left,** as originally designed with ball and roller bearings; and, **right,** as modified with ball bearing only

Fig. 9 Development of the Proteus engine to higher powers and better economy has continued in parallel with airline service



experience ahead of passenger service, in addition to carrying out all normal bench testing at overload temperatures, long-life disks are continually running on special cyclic tests, 100 hr of which is equivalent to 1000 hr of airline operation.

The integrity of the static components adjacent to the turbine disks is just as vital as the integrity of the disks themselves. Failure of such components could lead to contact with the disks and cause dangerous overheating from mechanical friction. These static components receive as much attention as the disks themselves, and even minor defects on them which arise in service are dealt with energetically.

So far, the Britannia has never experienced a turbine-disk burst, and Bristol engineers are trying to keep it that way.

Glaze Ice

All airworthiness authorities require demonstration that an engine will function properly under icing conditions, resulting from the presence of supercooled water droplets in the atmosphere. The anti-icing system used on the Proteus utilizes heating of the hollow compressor-entry guide vanes by compressor delivery air and heating of the power-plant intake with a controlled mixture of turbine gas and ram air. The engine and power plant performed faultlessly in tests and have an unrestricted clearance for flight in the most severe icing conditions.

In practice, the reverse-flow intake provides a great measure of protection. On one test with no anti-icing services in use, the complete power plant was flown for 43 min in ice at −4 C with a power loss of only 3 per cent, despite large buildups on the cowl entry.

After these tests, it was a complete surprise when the Britannia experienced engine flame-outs in the intertropical zone during BOAC's African-route proving trials, prior to passenger service. Eight expeditions were made to Entebbe in Central Africa, two to Singapore, and one to Darwin in North Australia to determine the cause. An extensively instrumented aircraft was used which included closed-circuit television to observe the compressor-entry guide vanes.

It soon became clear that these troubles were associated with dry-ice crystals in the air which occur in quantity only in the intertropical regions such as Central Africa, India, and Southeast Asia. Previous aircraft had not been able to fly at the heights where these concentrations are heaviest.

The ice crystals accumulated in various regions of the power-plant intake. They were soon dislodged and passed into the engine, causing compressor fluctuations or, in severe cases, flame-outs. Platinum glow plugs were developed and fitted to four of the eight combustion chambers. They insure instantaneous relights in all but the severest incidents. A more basic cure was the elimination of any crevices or discontinuities in the intake where ice could accumulate. Mixed dry ice and free water continued to be troublesome until air jets were installed at the entry to the rear elbow of the intake. These literally sweep the intake clean. All of these modifications are now incorporated in every Britannia currently flying.

The Future

Development of the engine to higher powers and better economy has continued in parallel with airline service, Fig. 9.

The techniques employed include the use of improved materials to permit higher turbine-entry temperatures, better component efficiencies on both compressor and turbine, and improved control systems to permit closer matching of the compressor and turbine characteristics. It is clear that the rugged design of the engine has provided a firm basis for its continued development.

A further interesting feature is that the engine layout, combined with the free turbine, makes it eminently suitable for a number of nonaviation roles, and it is already in use in naval fast patrol vessels and for stationary generating plants.

FEEDBACK...

...Consumer to Factory

Management's own decisions aimed at steadying the production system may, in fact, be causing violent fluctuations. What's wrong with the information fed back from retailer to factory?

By **R. E. McGarrah**

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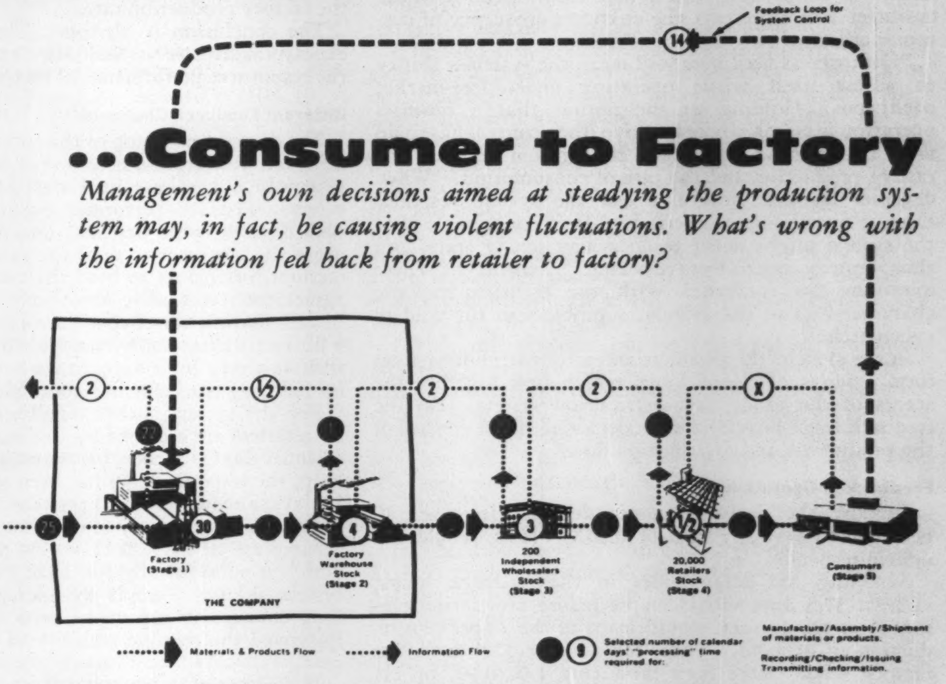
Feedback Loop for System Control
14
2
½
2
2
X
22
25
30
4
3
½
Factory (Stage 1)
Factory Warehouse Stock (Stage 2)
200 Independent Wholesalers Stock (Stage 3)
20,000 Retailers Stock (Stage 4)
Consumers (Stage 5)
THE COMPANY
Materials & Products Flow
Information Flow
9
Selected number of calendar days' "processing" time required for:
Manufacture/Assembly/Shipment of materials or products.
Recording/Checking/Issuing Transmitting information.

Schematic diagram of a typical Production and Distribution System with a Feedback Loop from Consumers to the Factory for controlling the system's response to orders

The concept of dynamic stability for the flow of materials, products, and money is not an abstract thought. Social, political, and economic pressures against violent fluctuations of business activity have an impact on practical business managers. Management's decisions themselves add to these pressures. For, by increasing the capital investment per employee to obtain the benefits of automation, management commits the firm to greater risks of financial loss from violent, cyclical, and seasonal ups and downs of business.

There are real advantages to be gained by considering business activities as if they comprised a homeostatic system; that is, a set of interconnected activities that are self regulated by information feedback. Organization charts, statements of policy, and financial records, of themselves, fail to portray explicitly the lines of flow that show how a business really lives.

Is the sustaining purpose of a business system essentially responsive—or stimulative? Do producers stimulate consumers to buy, or do consumers stimulate producers to manufacture? For this discussion, assume that the purpose of a business system is to respond to real (not predicted) orders received from customers.

Flow of Information

Fig. 1 shows schematically the essential structural characteristics of a production and distributive system: Without these information and materials flow-lines, no business could be transacted. (We are taking the simple, deterministic viewpoint, which holds that a measure of a system can be adequately described by a fixed, functional relationship. A probabilistic viewpoint recognizes explicitly the possible variations in the measures assigned each parameter of the system, and hence is more complicated.) Numbers in black circles on the vertical lines represent the average number of days between the various replenishment ordering decisions. Numbers in white circles along the horizontal

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FEEDBACK...

...Consumer to Factory

lines represent days for purchase orders to be transmitted by mail to preceding stages, and for orders to be transmitted to the persons who handle them. The X in the customer line represents the unknown frequency of customer orders.

"Control" as used here will mean the system's ability to adjust itself while operating under free-market conditions. Holding to the notion that a business operation is essentially responsive, then control has to do with maintaining a dynamic equilibrium between the rate of production and the rate of consumption. When demand changes, how fast can the system respond? Does it overshoot, or oscillate? Is it conceivable that the system might never reach a new steady state, and thus destroy itself from dynamic instability? These questions are concerned with the transient-response characteristics of the system, a problem in the field of cybernetics.[1]

In the sketch, the products and information flow-lines form a series of closed loops which link together the stages of the production-distribution system. Do the feedback loops provide the means for adequate control of the production and distribution flow?

Feedback in Operation

Suppose the daily consumer demand decreased 10 per cent to a steady rate of 0.90X. How would the system respond?

Summing the delay times in the feedback loops, at least 37.5 days would elapse before production personnel at the factory would learn of the 10 per cent reduction in demand. Thus, for at least 37.5 days, the factory would have been producing 1.00/0.90, or 111 per cent, of the new daily consumer-supply requirement. An excess of 11 per cent would have accumulated each day in inventory at the factory warehouse, wholesalers, and at retailers. If the "normal" days' supply of inventory is considered as 1.0, then in terms of consumer-demand rate, the actual days' supply of inventory in all stages of the system would have been increased to $0.11 \times 37.5 = 413$ per cent of the "normal" days' supply. To bring inventories down, wholesalers, retailers, and factory-ordering groups would decrease the quantities ordered, and factory output would have to be cut back by substantially more than 10 per cent, until the excessive stocks were brought back to normal.

An increase in daily consumer demand would cause a violent swing in the opposite direction. After the 37.5 delay, risks of failure to meet consumer demand would rise sharply. It is not hard to picture this system always in a dynamically unstable condition in which factory output is changes violently up and down, while inventories are always either too high or too low.

Jay W. Forrester describes the results of experiments to obtain the transient response characteristics of a system almost identical with the one shown.[2] Forrester and his associates simulated the operation of this system on a digital computer which printed out the results in terms of a series of time curves of consumer demand, factory put-out, stock-replenishment orders, and inventories. All runs started with steady-state conditions. The results showed that such a system gave a dynamically unstable performance; that is, the system either did not return, or it returned too slowly, to a steady-state equilibrium. A single increase of 10 per cent in consumer demand caused a 43 per cent change in the factory production rate.

The conclusion is obvious: The feedback loops are clearly inadequate as feedback channels for controlling the responsive performance of such a system.

Different Feedback Channels

The dotted line at top of the sketch is the addition of a feedback loop from the consumer back to the factory, a type which has long been used by appliance manufacturers. Product performance-warranty cards are attached to the products, and information on these cards urges the customer to mail the cards back to the manufacturer, ostensibly to bind the company to a guarantee agreement. Actually, these cards are a prime source of information about consumer sales. If the percentage who remit these cards is established as fairly constant, then at a very little expense we have a feedback channel for reducing the delay in response by the system.

For the system shown, feedback data on units sold by retailers are received by the manufacturer within 14 calendar days. Hence, by providing the direct feedback loop, the response delay has been reduced by $37.5 - 14 = 23$ days, a reduction of 63 per cent. During the 14 days' delay, the days' supply of inventory in the system would accumulate to $14 \times 0.11 = 154$ per cent of "normal," which is substantially less than the 413 per cent of the system shown. Simple by adding the direct feedback loop connecting consumers with the factory, we have improved the relative stability of the system by 63 per cent.

If we have a system which instantaneously feeds back data about every unit of product leaving the system, then the issue of overcontrol versus undercontrol can be resolved by determining how the feedback data should be used. We must find a consistent method of treating these data so that the responsive performance is neither too sluggish nor too quick.

Some daily or weekly variations in consumer demand occur as if by a pure random phenomenon. To prevent overcontrolling the system, the effects of these variations must be filtered out. One might select both a time period and a quantity to which a short-term change is permitted to accumulate, before any change in the production rate.

The Fallacy of Constant Stock Turnover

One widely used inventory-decision rule contains a fallacy. This is the rule to carry enough stock at any stage of the system to insure a constant ratio of units shipped to units in stock—to insure a constant inventory turnover. An example will serve to illustrate the disruptive effects of this rule.

Consider the system in the sketch. Suppose consumers have been buying the product at the sustained aggregate rate of 2000 units each week, and that each retailer orders enough to turn over his stock every two weeks. Similarly, suppose wholesalers order enough to turn over their stock once every three weeks, and the factory warehouse manager orders enough from the factory to insure a stock turnover once every three weeks. Estimates of demand are equal to the latest weekly shipments from stock. Finally, suppose that consumer demand per week dropped by one per cent, from 2000 units to 1980.

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[1] See Stafford Beer, "Cybernetics in Industry," a paper delivered at the Royal Swedish Academy for Engineering Sciences, April, 1958. Paper mimeographed by the United Steel Company, Ltd., Sheffield, England.

[2] Jay W. Forrester, "Industrial Dynamics," Harvard Business Review, July-August, 1958.

Here are the results of using this rule:

1 Retailers	Units
At the beginning of the week during which the drop occurred (time = 0), dealers would have on hand..........	4000
During the week of the 1 per cent decrease in sales, retailers' stock are depleted by 1980 units................	1980
Stocks then on hand (time = 1)........................	2020
Inventory desired at the end of the week following the sales drop (time = 2) is 2 × 1980.........................	3960
Therefore, the order quantity required from wholesalers to replenish stocks to the new desired level is 3960 − 2020...	**1940**
2 Wholesalers	
Stock on hand at time = 1...............................	6000
Quantity shipped during week from time = 1 until time = 2, equals the quantity ordered by retailers..............	1940
Stock on hand as of time = 2..........................	4060
Inventory level desired as of time = 3, is 3 weeks' supply based on latest shipments, or 3 × 1940................	5820
Therefore, the order quantity required from the factory warehouse to replenish to the desired level is 5820 − 4060..	**1760**
3 Factory Warehouse	
Stock on hand at time = 2............................	6000
Units shipped during week from time = 2 to time = 3, equals the quantity ordered by the wholesalers..........	1760
Stock on hand as of time = 3..........................	4240
Inventory level desired as of time = 4 is three weeks' supply of 3 × 1760 which is...............................	5280
Therefore the order quantity required from the factory to replenish warehouse stock to the new desired level is 5280 − 4240..	**1040**

Thus a strict application of the constant stock turnover rule would require that the quantity ordered from the factory be reduced from 2000 units to 1040, or a drop of 48 per cent—because of a mere one per cent drop in consumer demand. This can cause violently unstable operating conditions throughout a business system.

In the example, we assumed instantaneous deliveries of all replenishing orders. This eliminates response-delay as a possible cause of instability. Thus this decision rule for using feedback data is shown to be the sole cause of instability in operating a business such as the one shown. In fact, strict application of this rule would cause the business to destroy itself.

Todd and Scharf[3] have shown empirically that the stock-sales ratio decreases as sales increase. Literature on economical stock reordering shows that the replenishment orders increase with the square root of the increase in future sales or shipments from the factory.[4] These are approaches to practical ways of resolving the problem of inventory ordering decision rules.

Demand Data From Two Sources

The manufacturer in a production-distribution system such as the one described receives two different sets of customer-demand data, both automatically fed back by the system. For a variety of reasons, these two sets of data will differ in terms of quantities, models, or styles any time they are compared. To which customers should the manufacturer respond—his enfranchised wholesalers or "his" consumer customers—when their respective demands indicate different actions to take?

If he used data from consumer sales, he risks not being able to fill orders from his wholesalers. Short shipments and/or delayed shipments interfere with wholesalers' activities and cause a strain in relations. On the other hand, if he uses the data fed back from wholesalers, he risks the consequences of instability.

To confound this issue further, suppose the manufacturer makes regular forecasts of the number of units to be shipped to consumers, retailers, and/or wholesalers during a future operating period. Now he has three sets of demand data. These data may not be in close agreement with respect to total quantities and variety of models to be produced.

Facing this problem can be beneficial to the manufacturer. The fact that he considers all three sets of data before setting his operating schedules is an assurance that he is using all of the pertinent demand information available. His programming decisions should therefore be "better." That is, their consequences should be less costly and/or more profitable.

To Promote Stability

It would be naive to imply that providing a facility to feed back consumer demand and establishing procedures for using feedback data are the only means of attaining greater stability.

Time curves of wholesalers' and consumers' demand data will show the "inherent" of the "natural" variability of the consumers' demand to which a manufacturing firm must respond. If these curves show variations that are too costly for the manufacturer to sustain by carrying inventories and/or by changing his operating rates, then he can consider various marketing plans for promoting greater stability. This means he can resort to stimulative efforts such as advertising campaigns, sales contests, and so on. Moreover, by examining the patterns shown by the time curves, he can "phase in" these stimulative efforts at times when they will most likely result in stabilizing the rates of consumer demand.

It is possible that adoption and use of data regularly (if not automatically) fed back from consumer markets can mitigate the necessity for more elaborate and extensive market forecasting efforts. If delays are reduced in transmitting and analyzing data measuring real consumer sales, it may not be necessary to spend as much time and effort as are presently spent to obtain more accurate measures of predicted consumer sales.

It has been shown that feedback delays and the fallacious use of feedback information cause a resonance to develop in the flow variations characterizing business activities. The effect of this resonance is a boom-bust pattern. It is within the province of an intelligent business manager to reduce if not eliminate these causes.

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[3] F. B. Todd and I. Scharf, "Profitable Inventory Levels," Harvard Business Review, September-October, 1953.

[4] T. M. Whitin, "The Theory of Inventory Management," Princeton University Press, 1953.

GE applies tape control to the milling of long, steam-turbine buckets.
Result: Engineers have more freedom in designing contours—and manufacturing costs are less.

By Richard H. Wilke[1] and Abdon Rubio,[2] General Electric Company, Schenectady, N. Y.

Steam-Turbine Buckets ...AUTOMATICALLY

AN INCREASING need to reduce costs on relatively short manufacturing runs hastened the decision to shift to numerically controlled milling of l-p steam-turbine buckets. The system adopted after considering numerous proposals represents a marriage of the techniques developed for tracer servo control and the digital techniques of the modern computer. With this system the bucket designer is no longer restricted by tooling and setup costs. He can concentrate his efforts on achieving the best mechanical and aerodynamic bucket designs possible, knowing that he may specify different combinations of arcs of circles and straight lines (up to 100 arc segments) for each cross section, Fig. 1. At the same time the design cycle, tool, and manufacturing costs have been materially reduced.

Information Flow

The design of a bucket ends with a table of co-ordinate values describing the desired airfoil shape for as many as 24 cross sections. These cross sections are spaced along the length of the bucket as closely as necessary to prescribe the changes in bucket contour. An example of the form in which the data is recorded is given in Fig. 2. Each horizontal group of numbers serves to define completely one cross section; and its relationship to the remainder of the bucket is shown on the associated figure. The origin of the co-ordinate system has been fixed at the center of gravity of each cross section. However, a shift to any desired machining center line may be specified in the machining-information input. A radius of 10^6 in. is interpreted by the computer as a straight line. The dotted trajectory shown in Fig. 2 depicts one of the ultimate milling-cutter-center paths. As many as 250 such strokes may be requested for machining one bucket.

The steps preliminary to fabrication of a bucket start by feeding into an IBM-704 computer the basic numerical description of the bucket profile, Fig. 1. Also required are the index angles associated with each of the milling strokes, the starting and ending locations and the cutter dimensions. The flow of information is shown schematically in Fig. 3. It shows that the geometric and tool descriptions are manipulated so as to form a table of cutter-center locations which is then interpolated to result in discrete information for the cutter-center motion for each milling stroke. The cutting path is calculated by adjusting the motion for the cutting-tool center, three-dimensionally, so that tangency between the cutter and bucket envelopes is achieved. A detailed discussion of the manner in which this is accomplished through the use of a general tape is included in a companion paper.[3] (See also "Numerical Control," MECHANICAL ENGINEERING, May, 1959, pp. 56–70.) Highly twisted buckets considerably complicate the calculation and make use of a high-speed computer necessary.

The regions between the specified cross sections are faired within the computer with a second-degree curve so that the output becomes a magnetic tape with two-dimensional position, velocity, and acceleration information calculated for each small increment along each stroke. This tape then contains, in digital form, all of the information necessary for the machining of a particular bucket, including such functions as cutter start and stop and cutting-oil on-off. Depending on how many machine strokes and specified cross sections are involved, between 25 and 45 min of IBM-704 time are required for one run. If any errors have been made, a complete computer rerun is necessary, there being no way to modify the completed magnetic tape. The roll of $^1/_2$-in-wide tape is then inserted in the director which produces the 1-in-wide analog tape containing continuous and intermittent-function information. Positioning information is given by phase difference between the controlled motion and the reference signal, all of which are 200-cps square waves. The director operates in real time and will produce as many tapes as required for a complete bucket depending on the total machining time. Counting zero-motion time as well as the various stops, approximately 1 hr of machining time is produced by each standard analog tape. The digital tape from the IBM-704 may be passed through the director many times so that duplicate tapes may be produced to operate a bank of milling machines or to replace broken or otherwise inoperable analog tapes.

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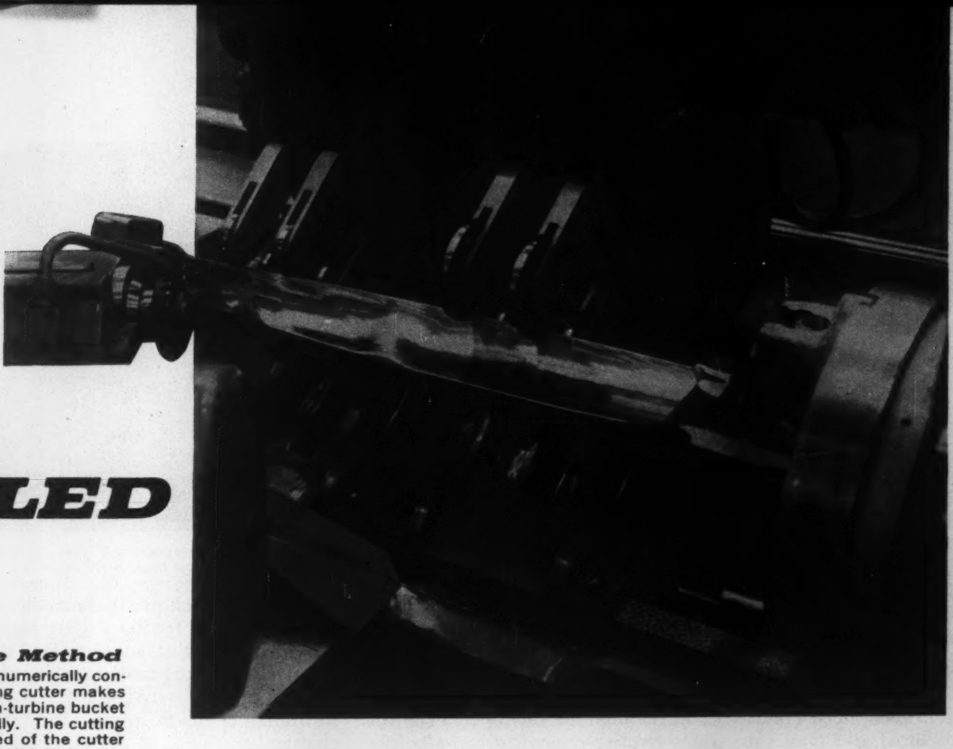
[1] Specialist, Machine Tool Development, Manufacturing Engineering, Large Steam Turbine-Generator Department.

[2] Development Engineer, Turbine Bucket and Rotor Engineering, Large Steam Turbine-Generator Department. Assoc. Mem. ASME.

Contributed by the Machine Design Division and presented at the Annual Meeting, Atlantic City, N. J., November 29-December 4, 1959, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Paper No. 59—A-98.

[3] R. G. DeBiase, "Determination of Cutter Trajectories for Contoured Turbine Buckets," ASME Paper No. 59—A-111.

MILLED



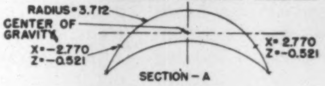
...The Method

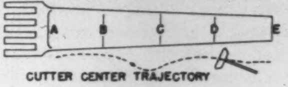
Fig. 1 A numerically controlled milling cutter makes a steam-turbine bucket automatically. The cutting path required of the cutter center as the stroke progresses is clearly evident from the spiral-like cutting-tool marks. Selsyns provide electrical-output position-feedback signals for comparison with the computer program.

...The Part Description

Fig. 2 A table of co-ordinate values describes the desired airfoil shape. Five cross sections are used in this description, although as many as 24 may be used. Each horizontal group of numbers serves to completely define one cross section.

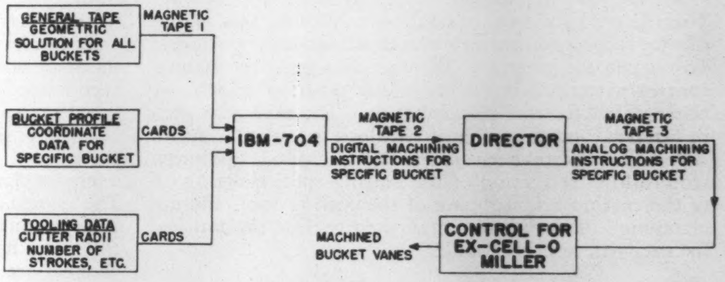
RADIAL LOCATION									
A 0.000	X	-3.250	-3.250	-2.770	2.770	3.250			
	R	10^6	7.800	3.712	8.125	-4.621			
	Z	-1.700	-1.650	-0.521	-0.521	-1.650			
B 6.000	X	-3.110	-3.031	2.528	3.120	3.120	-3.012		
	R	0.625	3.621	11.125	10^6	-4.290	0.075		
	Z	-1.076	-0.881	-0.420	-1.560	-1.750	-1.172		
C 12.000	X	-2.825	-2.712	2.125	3.250	-2.560			
	R	0.625	3.500	20.000	-7.500	0.125			
	Z	-0.775	-0.600	-0.312	-1.650	-0.764			
D 18.000	X	-2.500	-2.480	1.631	2.850	2.160	-2.250		
	R	0.625	2.750	16.500	10^6	-3.500	0.125		
	Z	-0.412	-0.210	-0.250	-1.780	-1.250	-0.425		
E 24.000	X	-2.550	-2490	1.627	2.800	2.190	2.210	-2.248	-2.420
	R	0.750	2.700	16.000	10^6	10^6	-4.000	0.750	0.075
	Z	-0.410	-0.250	-0.245	-1.770	-1.935	-1.192	-0.412	-0.500


RADIUS = 3.712
CENTER OF GRAVITY
X = -2.770
Z = -0.521
X = 2.770
Z = -0.521
SECTION – A


A
B
C
D
E
CUTTER CENTER TRAJECTORY

...The Machine

Fig. 3 Three separate tapes are prepared for the numerical control of bucket-vane milling. The first, containing the geometric solution for all buckets, is combined in the IBM 704 with card-input co-ordinate data on a specific bucket profile and tooling data. The computer output is a second tape containing digital machining instructions for a specific bucket. The director converts this into the final analog machining instructions on a third tape.


GENERAL TAPE
GEOMETRIC SOLUTION FOR ALL BUCKETS
MAGNETIC TAPE 1
BUCKET PROFILE
COORDINATE DATA FOR SPECIFIC BUCKET
CARDS
TOOLING DATA
CUTTER RADII
NUMBER OF STROKES, ETC.
CARDS
IBM-704
MAGNETIC TAPE 2
DIGITAL MACHINING INSTRUCTIONS FOR SPECIFIC BUCKET
DIRECTOR
MAGNETIC TAPE 3
ANALOG MACHINING INSTRUCTIONS FOR SPECIFIC BUCKET
CONTROL FOR EX-CELL-O MILLER
MACHINED BUCKET VANES

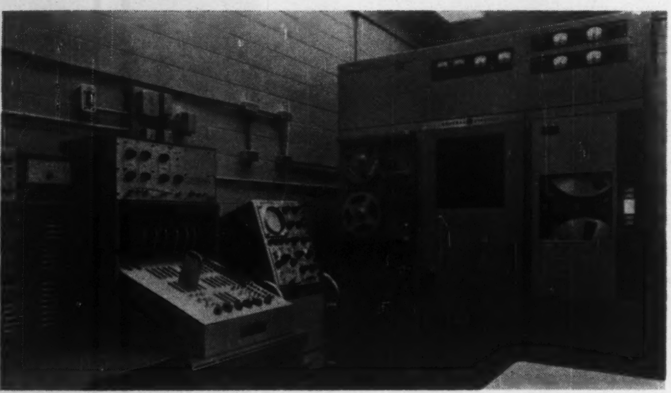


Fig. 4 In addition to the digital-to-analog conversion, the director performs some interpolation calculations. An oscilloscope read-out provides a visual check on any gross human input-information errors which might have been introduced.

Steam-Turbine Buckets ...AUTOMATICALLY MILLED

The phase analog tapes may be used over and over again in the machine-tool control to manufacture as many buckets as desired. When a run is complete the tape may be stored or degaussed for use in a new bucket design. Though digital-quality tape is utilized, the atmospheric conditions in the manufacturing area are not ideal and may sometimes require renewing tapes before a row of buckets has been completed.

Machine Operating Cycle

Once the raw stock has been inserted into the special fixture in the machine tool and the start button depressed, the operator has about a minute of zero-motion time to make whatever differential selsyn adjustments he requires. The control system then clamps the headstock, tailstock, and the steady rests and the first stroke of the milling cutter begins. During the stroke the two control channels are electrically connected to the table and cross slide. After each stroke is complete the tool retracts, the steady rests are unclamped, and the channel normally used for table motion is electrically connected to the indexing head. The required work indexing is then accomplished, the control channel is reconnected to the table, and the workpiece clamped in the new position by headstock, tailstock, and steady rests. This sequence is continued until either the tape runs out or the full 360 deg has been traversed. If more than one tape is required for a bucket, suitable program stops are supplied to permit tape changes. For the purpose of machine tool, cutter, and workpiece inspections, planned stops may be programmed at the end of any desired stroke. The machine will come to a controlled halt at the next planned stop following the depression of the planned-stop button. This feature allows the operator to retract the tool manually for inspection, cutter replacement, or other purposes. To resume the program, the tool is jogged by manual control to within 0.050 in. of the position which the chart shows for this planned stop. The tape may then be restarted and the machine will lock into synchronism. When a bucket has been completely machined, a program stop follows retraction of the cutting tool, shutting off of the cutting oil, stopping of the cutting tool, and unclamping. The operator may then replace the finished bucket with another blank.

System Components

As previously stated, the IBM-704 is the first link in the system which produces machined buckets to specified contours. The feedback loop including the computer is provided by manual inspection of the finished buckets and comparison of the manufactured shape with the drafting layouts of the desired shape. Any discrepancies are due to human errors in input information, electrical and mechanical response of the component equipment, or malfunctions of one of the components.

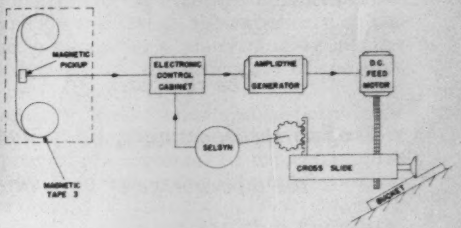
When the tape containing machining information for a specific bucket is completed by the IBM-704, it is passed through the director, Fig. 4. The director is basically a digital-to-analog converter which also performs some interpolation calculations. It consists of two tape transports and completely transitorized pull-out electronic circuits of digital-computer quality. The motion of the table, cross slide, and indexing head may be observed on an oscilloscope as the analog tape is being produced since it operates in real time. Most malfunctions which have occurred previous to this step may be spotted in this way. Gross human input-information errors may also be observed by noting unusual motions of the table or cross slide on the oscilloscope.

As soon as the completed analog tape has been produced by the director it may be inserted into the tape transport operating the controls for the miller, Fig. 5. This integrated system consists of the tape-transport cabinet, three control cabinets, and the cutting tool and base. The electronic-control cabinets include the electronic-power supply, controlled selsyn exciter, phase discriminators which provide a d-c voltage proportional to the phase difference between the director and feedback position signals, and the amplidynes and amplidyne-electronics control to cause motor speed to be proportional to the discriminator output.

As can be seen from the functional illustration, Fig. 6, the magnetic pickup head reads the position intelligence as contained on the magnetic tape and provides this data to the electronic controls. For any particular motion channel, the position intelligence is in the form of magnetic pulses of a given phase relationship with respect to a reference channel which also consists of magnetic pulses. The system is set up so that 3.6 deg of phase shift of the 200-cps square wave is equivalent to 0.001-in. travel of the linear motions. The signals read from the reference channel are utilized in the electronic circuits to control the excitation of the position-feedback selsyns which are geared to the machine motions. The selsyns provide an

Fig. 5 The blade-manufacturing apparatus consists of a tape-transport cabinet, three control cabinets, and the cutting tool and base. The electrical output for the various control and comparison systems is provided by the electronic-control cabinets.

Fig. 6 For any particular motion, the magnetic pickup head reads the position intelligence contained in the magnetic tape, providing data for the electronic controls. This is in the form of magnetic pulses of a given phase relationship with a reference channel which also consists of magnetic pulses. A 3.6-deg phase shift of the 200-cps square wave is equivalent to 0.001 in. of linear travel.



electrical output signal indicating the angular position of the selsyn shaft.

In this way, motion of the feed drives gives the selsyn rotary motion, and therefore a changing electric signal which is a function of tool position. The electronic controls continuously compare this selsyn signal with the corresponding motion signal as obtained from the magnetic tape and act upon the drive motor to keep the two signals in close phase correspondence and consequently cause the tool to follow the tape-programmed cutting path. Fig. 1 shows the relationship between the milling cutter and a finish-machined bucket. The devious cutting path required of the cutter center as the stroke progresses is clearly evident from the spiral-like cutting-tool marks.

Operating Experience and Conclusions

The introduction of numerical control for the manufacture of l-p steam-turbine buckets by the authors' company was a big step forward especially when it is considered that no other equipment was on hand to manufacture the very long freely designed buckets scheduled for immediate production. Development problems had been largely overcome before shipment of the components, so that by the time installation took place consistently reliable results were obtained. The first runs were concerned with the production capabilities of the machine tool to determine if the 5-hp cutter-drive motor could handle the 3/16-in-deep cuts scheduled at the table feeds desired. A drastic reduction of the number of planned stops was necessary to reduce the over-all machining time. The accuracies which the over-all system could achieve under extreme contour conditions were also of vital concern. In all respects the system performed admirably. For example, comparator checks of sample bucket cross sections showed that a tolerance of ± 0.002 to 0.003 in. was being achieved. Some of the control and milling-machine specifications are listed in Table 1. All of these were found to be adequate even for the high-hardness-level steels being machined.

To date, the machine tool, its control, and auxiliary equipment have been trouble free. The director originally caused the most apprehension as far as maintenance is concerned. A special testing rig was constructed which could individually check the various transistorized plug-in boards, Fig. 4. So far there have been no malfunctions attributable to the director and none of the plug-in boards have been replaced. The difficulties encountered have been mainly human or computer errors.

Table 1 Tape-Controlled-Miller Specifications

Maximum workpiece length, in.	72
Maximum cutting-stroke length, in.	60
Available cutter speeds, rpm	190 to 2138
Available cutter diameters, in.	up to 8
Cutter-drive motor, hp	5
Tape speed, fpm	75
Tape length (0.0015-in-Mylar), ft.	5000
Maximum manual feed rate (table), in. per min	120
Maximum manual feed rate (slide), in. per min	120
Maximum manual feed rate (head), rpm	22.5
Maximum tape feed rate (table), in. per min	80
Maximum tape feed rate (slide), in. per min	80
Maximum tape feed rate (head), rpm	15

The development of a numerical-control system for the manufacture of complex-shaped l-p steam-turbine buckets has been highly successful. The high accuracies maintained in the machined bucket are due to the high-quality workmanship in the machine-tool and control components. Circuit, analytical, and design decisions were always conservatively made. The design of the machine, from the servo standpoint, requires that the typical disturbing elements such as friction, backlash, and deflection be brought within quite narrow limits. Each of these factors received close attention. Much the same care was exercised in the design of the control equipment, director, and general programming tape. Close liaison between the many contributors was necessary to insure that the final equipment could provide the flexibility, accuracies, and speed required in modern bucket design, particularly since no one contributor was in a position to write specifications for all functions.

The present system allows the bucket designer more shape and contour freedom than ever before. This should result in more efficient, stronger, and more economical buckets. Economic gains should accrue from a shorter design cycle, much less tooling design and inventory, and much less machine-shop labor through less handling, idle, and setup time. One can be sure that the largest benefits are yet to come.

Acknowledgment

Much of the credit for the successful development of numerical control for the machining of complex-shaped steam-turbine buckets is due to the untiring and co-operative efforts of personnel of the Excello Corporation, and the Electronics Laboratory, General Engineering Laboratory, and Speciality Control Departments of the General Electric Company.

The computer
offers speed, accuracy, and
the tape storage of information.
Needed now:
A new engineering
philosophy, opening the way to
the solution of complex problems
by numerical analysis.

ENGINEERING APPLICATION OF DIGITAL COMPUTERS

By H. D. Irwin[1],
Assoc. Mem. ASME
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As of 1958, over 240 large, 1000 medium, and 4000 small-scale computers had been installed [1].[2] Using reasonable assumptions, this would indicate a total capital outlay of the order of $800 million. Also as of 1958, roughly as many computers were on order as had already been installed. Annual sales of general-purpose computers has risen from almost nothing in 1952 to close to $350 million in 1957. Annual sales of $1 billion are predicted for 1960 [2].

Are computers worth while, and are they being used effectively? This question will be discussed from the viewpoint of the practicing engineer.

Advantages of Machine Computation

Some of the advantages of machine computation are: High speed of computation, durability of tape storage of information, and the high order of accuracy.

The high speed of present-day computers permits large complex problems to be undertaken economically in analysis, data processing, and design. Very likely, machine capability and programming skill will always lag behind what the more ambitious people require to handle the problems they would like to solve. On the other hand, machine capability and programming skill will probably continue to exceed what the majority thinks is needed and can be utilized effectively.

As to the permanent storage of company know-how on tape, machine instructions must be spelled out in agonizing detail. At first glance, this may appear to be a disadvantage. But there is genuine merit in having a process behavior pattern or a design procedure described in great detail. While this could be done without computers, computers force it to be done. This means that valuable company know-how can be permanently stored on master tapes. While a great deal of information can be stored in a human brain, the information is not very accessible to other minds, nor can it be stored rapidly. Furthermore, a man may leave the company. Safe, permanent storage of company skills is a tremendous advantage.

The third advantage of machine computation lies in the near total absence of random error. A machine instruction tape as first written very likely contains a number of clerical and logic errors. As each of these errors is discovered and corrected, it remains corrected. When the instruction tape is fully corrected, the chance of a mistake in subsequent calculations is extremely small, particularly in the better machines.

The most pressing problem, at least in certain industries, lies in obtaining acceptance of machine computation by engineering supervision and practicing engineers. There must be solid understanding of what computers can and cannot do and what this means to industrial technology. Before one can sell machine computation, one must sell an engineering approach which can profitably use computation.

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[1] Senior Service Engineer, Engineering Department.

[2] Numbers in brackets designate References at end of paper.

Contributed by the Process Industries Division and presented at the Annual Meeting, Atlantic City, N. J., November 29–December 4, 1959, of The American Society of Mechanical Engineers. ASME Paper No. 59—A-180.

The Empirical Method

Most of our industrial technology, faced with problems so difficult they could not be solved economically by manual numerical analysis, and not solved at all by sophisticated mathematical methods, has used an empirical or cut-and-try approach. There developed a high regard for the engineering man of action who could turn out the design of a new plant with only the bare bones of the required basic data. The man who relied on calculation and concerted mental effort, as well as experience, came to be regarded as an eccentric who could occasionally be useful.

In such an atmosphere, an engineer could retain the analytical skills he was taught in college only so long. The bulk of the engineers in the more empirical industries forgot their training in analysis and learned to use a cookbook.

The advent of the digital computer, with its promise of providing economical solutions to a large class of real engineering and scientific problems, brought an enthusiastic response in industries which were already using manual numerical analysis out of necessity, such as the aircraft and nuclear industries. However, the machines were also quite promptly bought or rented and installed for engineering use in the more empirical industries.

The engineers were told of their existence, given a few short indoctrination lectures, and asked to use machine computation.

They could not use the machines to do their job as they had been doing it. The machines could do in about 20 minutes all the calculation they had done since they started in engineering.

A Change of Philosophy

In many industries, the computers can, in the short term, probably only increase engineering costs. In the long run, they can reduce over-all costs by producing better-engineered products and processes. However, utilization of the machines will require a change of philosophy. The man of action who can design a whole plant with little or no basic data will have to give way to the eccentric who likes to have the facts and base his designs on more precise prediction.

For the practicing engineer to adopt a more scientific approach to engineering problems, he must have the sympathy and understanding of his supervision. Certainly from the standpoint of the man-hours required for engineering computations, the more scientific approach is expensive. However, it is expensive only in the short term.

The costs of developing a scientific approach to a given engineering problem are capital costs similar to acquiring an expensive die for producing a machine part. If enough parts are to be produced, the expense of the die is justified. Similarly, if enough designs are to be turned out in future years, the cost of developing the most economical methods for predicting performance is justified. Furthermore, the more economical methods for performance prediction in terms of design parameters may lead to a sufficiently large improvement in the first design made to more than pay the cost of the methods' development.

Once engineering supervision is convinced that a more scientific approach to engineering problems is required, the battle is half won. Industry may then set up training courses for the practicing engineer—not training courses in computer use, but training courses in the use of more scientific methods of performance prediction in engineering work.

Computer Programming

Writing a program to solve a problem in engineering analysis or design is time-consuming and expensive. The cost of writing any given program depends upon the size and speed of the machine being used, the number of programs already written and tested, the experience of the programmer, the programmer's understanding of the problem he is programming, the generality of the program, and many other variables.

Programs are usually spoken of as special-purpose or general-purpose. The dividing line between the two is not clear. All programs are general to the extent that the numbers they use as parameters and the numbers upon which they operate can be changed. Therefore, even quite limited programs have some degree of generality. However, a program of limited usefulness such as a simple program which a man writes to help him in doing a portion of a one-time calculation would certainly be regarded as a special-purpose program; whereas a program which handles a purely mathematical function, such as matrix inversion or the solution to a first-order linear differential equation, would most certainly be regarded as a general-purpose program.

A man seeking to solve a problem on a computer may be faced with an array of choices. Assuming he has many different machines at his disposal, the type and size of problem and the method of obtaining a numerical solution must be considered in choosing the machine.

Having selected a machine, he must then decide whether he wishes to use existing general mathematical programs or to write a program. This choice is an economic one. For instance, he may choose to cast his problem into matrix form and use a matrix compiler program which has already been written. If the order of the matrix is low and the coefficients are constant throughout the problem, this is very likely the cheapest method, since no programming is required. On the other hand, if the order of the matrix is large and the bulk of the coefficients are zero, using the matrix compiler would generate a program very wasteful of machine time. He might, therefore, cast the problem in some other form and write a program which makes more efficient use of machine time.

Making Programming Easier

Many things are being done to make programming easier. Interpretive programs (fixed and floating point) have been written for practically all machines. Interpretive programs permit the use of more sophisticated program language in instructing the machine and, in the case of floating-point interpreters, keeps track of the decimal-point locations automatically.

Each instruction in an interpretive program causes a whole sequence of basic machine language commands to be executed. Interpreters use large segments of memory in internally programmed machines and are usually slower than equivalent programs written in basic machine language. In effect, interpretive systems slow the computers down to make things easier for the programmer. Most of the machine time penalty is associated with the floating point feature, and this feature is frequently quite desirable, so that the penalty is justified.

Another approach to easier programming is to use the machines themselves to write programs in basic machine language. In this case, the programs for writing programs are called "compilers." Abbreviated forms of command suffice to cause the compiler to construct the program. In some cases, the statement of the problem to the compiler is almost as brief as the mathematical notation itself.

A great deal of progress has been made in making programming easy enough to interest the practicing engineer in doing at least some of his own programming. A great deal of progress still needs to be made.

Probably the greater portion of the practicing engineers in industry today will depend upon professional programmers to write programs for them or upon using general-purpose programs already written by other people. Widespread personal programming of computers by engineers will probably require a new generation of engineers trained in numerical analysis and computer use in college.

A Library of Programs

One practical solution is program exchange. This system permits a company to obtain the use of many programs in exchange for some which it has produced. This is an excellent idea. At least in the short term, it should reduce the costs of programming considerably.

Many groups are setting up means for handling the program exchange function. Probably the first were organizations of users of a certain computer make and model. The users' organizations were generally sponsored by the computer manufacturer, since the existence of a large functioning group of users turning out general-purpose programs could be a powerful factor in new sales.

Some of the engineering societies are now setting up the permanent organization needed to handle the program library function on a continuing basis. However, a given program may be written in any of hundreds of different languages for any one of a large number of machines.

At present, for a program to be of much immediate use to a subscriber to the library service, the subscriber must already have—or contract to use—the machine for which the program was written, as well as any auxiliary interpretive and mathematical function subroutines which were used in the program. In other words, there is a serious language barrier in the way of efficient program exchange.

The argument made by proponents of program libraries is that the larger portion of the cost of programming lies in the analytical work which precedes coding for a given machine. A large portion of the work is in analysis and flow charting, and a properly documented program may be of use even if it has to be recoded for another machine type. It is also true that the machine to be used is a large factor in determining in what form to cast the problem. This means that, even if he is willing to recode the program, the man using the library program must have access to a machine of similar capabilities to that for which the original program was written, or even the flow charting may be of little use.

Overcoming the Language Barrier

While there seems to be no convenient way to overcome the difficulties caused by differences in machine capacity, there is a way of overcoming the language barrier, and some groups are working on this problem. The method suggested consists of having one universal language. Current thinking indicates that such a language would be problem oriented. It would be somewhat similar but more comprehensive than most compilers. Initial development is aimed at an algebraic language [3].

If a universal machine language were adopted, programs written for interchange would be written in the universal language either directly or by manual or machine translation. The library copy would be in universal language. A borrower would then either manually or by machine translate the universal language into the basic machine language of his own particular computer.

The program library, in conjunction with a universal language, would certainly have a beneficial effect on programming costs. However, general-purpose programming cost is very likely a larger problem now than it will be ten or twenty years from now as our machines become more sophisticated and our skill in programming grows.

The program library is viewed as an interim measure. That does not mean that the libraries being established today will not provide a useful service for many years, maybe for decades, but the serious problem which they seek to overcome may be of relatively short duration.

The difficulties in applying digital computers to the engineering problems of industry are not of the sort that can prevent ultimate large-scale use of the machines. But they need to be dealt with vigorously in order to achieve efficient use of the new engineering tools in the shortest possible time.

Conclusion

Efficient use of machine computation in engineering work requires two things: Acceptance by engineers and supervisors of an engineering philosophy which can profitably use computation, and overcoming the high cost of computer programming. Obtaining acceptance for machine computation is essentially an educational problem which must be undertaken by the engineering societies and industry itself. The high cost of programming can be alleviated, at least in the short term, by the adoption of universal computer languages in conjunction with program libraries.

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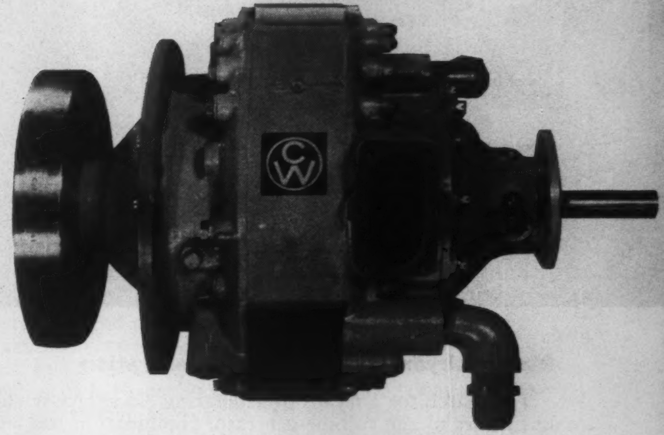
Abstracts and Comments Based on Current Periodicals and Events

D. FREIDAY
Assistant Editor

BRIEFING THE RECORD



Rotating Combustion Engine

Curtiss-Wright Corporation, in the company's own words, "partially took the wraps off" a new type of internal-combustion engine which is neither a gas turbine nor a reciprocating engine. Actually, it is a rotating combustion engine with a 4-in-thick triangular piston that rotates, rather than moving up and down. It is impelled by the explosion of a mixture of gasoline and air in the surrounding oblong casing, similar in shape to that for a Roots blower.

The triangular piston, which appears solid but is probably hollow, is the only moving part other than the crankshaft. The piston rotates in an eccentric course, furnishing the equivalent of a 3-cyl, 4-cycle gasoline engine, and is always in contact with the seals between it and the casing.

Full details will not be announced until the engine, which has a range of from 100 to 700 hp, is in production next year. The engine has been developed jointly with NSU Werke of West Germany.

An automotive carburetor supplies a mixture of gasoline and air into the engine chamber through a side wall port. As the engine's rotor turns, the mixture is compressed and fired by a single spark plug. The exploding gases deliver the power to the crankshaft through the rotor. Exhaust fumes escape through another port.

There are three power sequences per revolution to the crankshaft, maintaining an almost continuous intake, compression, ignition, expansion, and exhaust cycle.

Roy T. Hurley, Curtiss-Wright board chairman and president, claims that the rotating combustion engine combines the best features of the piston and jet engines, high efficiency, and work continuity, "to set new standards for internal-combustion-engine performance."

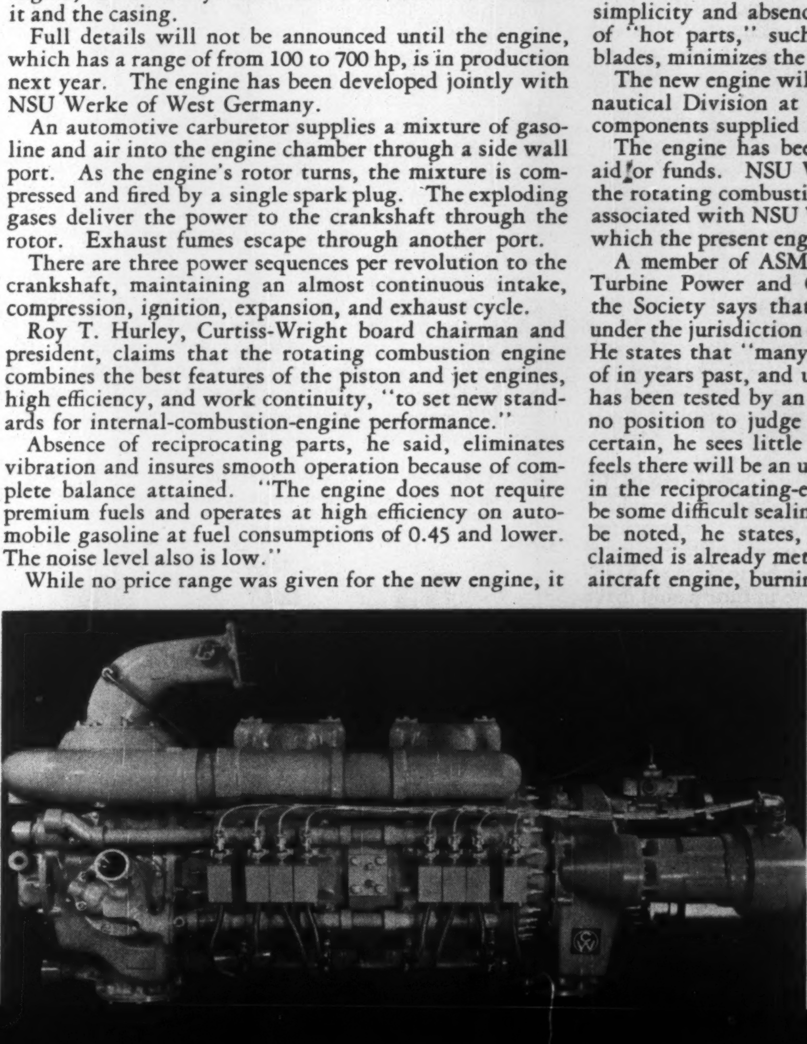
Absence of reciprocating parts, he said, eliminates vibration and insures smooth operation because of complete balance attained. "The engine does not require premium fuels and operates at high efficiency on automobile gasoline at fuel consumptions of 0.45 and lower. The noise level also is low."

While no price range was given for the new engine, it was said that it would be "low in cost because of its simplicity and absence of exotic materials." The lack of "hot parts," such as exhaust valves and turbine blades, minimizes the use of expensive metals.

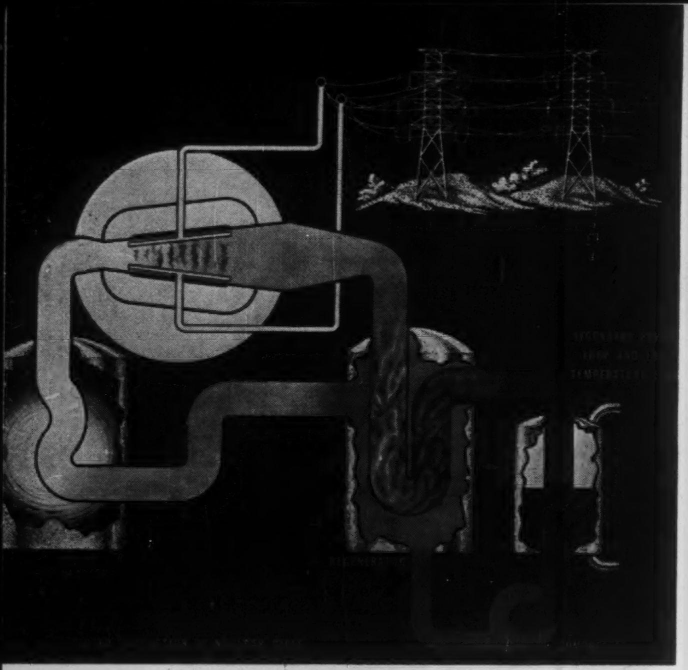
The new engine will be produced by the Wright Aeronautical Division at Wood-Ridge, N. J., with various components supplied by other Curtiss-Wright divisions.

The engine has been developed without government aid or funds. NSU Werke will announce its model of the rotating combustion engine shortly. Felix Wankel, associated with NSU Werke, invented the principle from which the present engine has been developed.

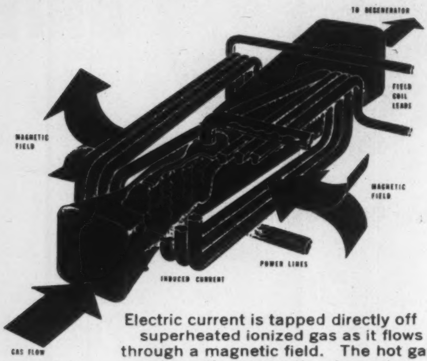
A member of ASME who is active in both the Gas Turbine Power and Oil and Gas Power Divisions of the Society says that the engine would be considered under the jurisdiction of the Oil and Gas Power Division. He states that "many kinds of engines have been heard of in years past, and until the rotary combustion engine has been tested by an outside organization, ASME is in no position to judge it." Although the future is uncertain, he sees little challenge to the gas turbine, but feels there will be an upset to a great deal of the thinking in the reciprocating-engine field. There will certainly be some difficult sealing problems to solve, and it should be noted, he states, that the 0.45 fuel consumption claimed is already met with Curtiss-Wright's own radial aircraft engine, burning gasoline.



Above, the Rotating Combustion Engine would replace the reciprocating engine with a triangular piston that rotates in an eccentric course, furnishing the equivalent of a 3-cyl, 4-cycle gasoline engine. A range of 100 to 700 hp is claimed for the engine developed jointly by Curtiss-Wright and NSU Werke of West Germany. It will be in production next year. **Left,** an application of the rotating-combustion-engine principle is the YRC 600 supercharged engine, being developed for aircraft and other applications.



The MHD Cycle. A chemical furnace or nuclear reactor heats and ionizes working gas. This flows through a magnetic field in the MHD generator, where d-c electricity is tapped off the ionized gas by means of electrodes in the generator. Gas is then cooled in the regenerator and heat sink, compressed, and then preheated in the generator prior to re-entering the furnace for heating and ionization.



Electric current is tapped directly off superheated ionized gas as it flows through a magnetic field. The hot gas replaces the conventional armature.

Magnetohydrodynamic Power Generation

The search for a means of generating electricity without resort to the turbine-generator combination has led to recent improvements in fuel cells, thermionic converters, and other devices. Attention has recently turned to the field of magnetohydrodynamics, MHD. Concerned with the interaction between magnetic fields and ionized gases, MHD offers a potential 25 per cent increase in the thermal efficiency of the generation of electricity.

A laboratory-scale plant developed by the Avco-Everett Research Laboratory passes a high-temperature high-velocity gas stream through a strong magnetic field to generate current. Thus the armature of a conventional generator would be replaced with a moving steam of hot ionized gas. The ionization of some gas mixtures, which makes them electrically conducting, can be achieved by heating them to 3000–5000 F.

As described in an article, "Magnetohydrodynamics—Future Power Process?" by Philip Sporn, Hon. Mem. ASME, president of American Electric Power Service Corporation; and Arthur Kantrowitz, director of the Avco-Everett Research Laboratory; in the November, 1959, issue of *Power*, the proposed power-plant cycle would utilize ordinary combustion gases at 5300 F seeded with metal vapor.

After producing 360 mw of d-c electricity in the MHD generator, the gas would pass on to a regenerator which would partially preheat the intake air. Superheater, reheater, and evaporating sections would utilize more of the remaining heat in a closed cycle to power high-pressure and reheat turbines. These in turn would drive the air compressor, and the steam would be further utilized by a low-pressure turbine-generator combination to add another 97 mw to the electrical output.

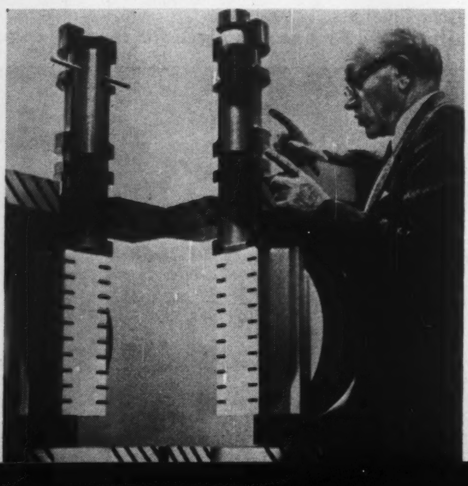
In this cycle the steam turbines, boiler, compressor, a-c generator, feedwater heaters, and their auxiliaries are essentially conventional equipment and represent no problem in development. The MHD equipment, however, represents special problems which would require research and development effort, particularly on the behavior of high-temperature gases in magnetic fields and on high-temperature materials. Fortunately both areas are also of interest to the development of a nuclear-fusion power process and to missile re-entry problems.

The major hitch to the process is the present limitation of MHD generation to direct current. This requires costly conversion, at a capital cost of $40 per kw.

Formidable problems must be faced before a plant like this can be designed and operated. These consist mainly in understanding the stability of current paths in the gas, electrode effects, and other MHD phenomena. In addition, materials must be developed to handle gases at the very high temperatures—in the 3000 to 5000-F range—which would be encountered.

Viewing the actual construction of an MHD power plant as some 10 to 20 years away, a group of 10 electric utilities and Avco have agreed to proceed with a program of research on an MHD generator. American Electric Power Service Corporation, New York, will serve as agent for and will represent the utilities, which are: Appalachian Power Company, Central Illinois Light Company, The Dayton Power and Light Company, Illinois Power Company, Indiana & Michigan Electric Company, Indianapolis Power & Light Company, Kansas City Power & Light Company, Louisville Gas and Electric Company, Ohio Power Company, Union Electric Company.

Philip Sporn, Hon. Mem. ASME, president of American Electric Power Service Corporation, examines a model of the experimental MHD generator



Smog Eye Irritants Identified

Two chemical compounds, one best known as an embalming agent and the other for its use in chemical warfare, have been labeled by the Air Pollution Foundation, San Marino, Calif., as the probable eye irritants in West Coast smog.

Formaldehyde and acrolein are formed in small amounts in the atmosphere when sunshine irradiates automobile exhaust, and both of these aldehydes have been shown in recent laboratory work to produce the eye irritation characteristic of photochemical smog.

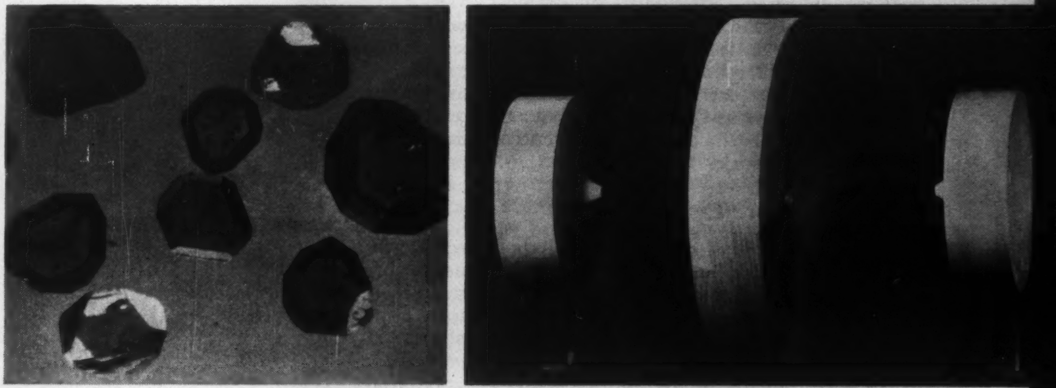
Both compounds, the Foundation emphasized, in its new technical report (No. 29), are formed from the action of sunlight on olefinic hydrocarbons in the atmosphere. At least 95 per cent of the olefins found in the air come from exhaust tailpipes of motor vehicles.

Diamond-Making Process Revealed

Security restrictions have been lifted to permit General Electric to reveal the process by which it has been making man-made diamonds in the laboratory since 1955 and in commercial quantities since October, 1957.

The essential breakthrough that enabled carbon to be transformed into diamonds was the use of a molten metal catalyst which acted as a thin film between the carbon and the growing diamond crystal, and the development of new superpressure and high-temperature apparatus.

Without the catalytic action, it is estimated that 3,000,000 psi and over 7000 F would be required to transform carbon into diamond. There is no equipment in existence that could produce such a combination of sustained pressure and temperature.



Photomicrograph of laboratory-made diamonds, and a model of one of the devices for sustaining the ultrahigh pressures and temperatures required to change graphite into diamond. Conical pistons push into opposite faces of the mating center chamber and compress the graphite placed in the aperture at the center of the chamber.

The use of catalyst metal made it possible to produce the diamonds at 800,000 to 1,800,000 psi and 2200 to 4400 F.

The nature of the starting material used to supply the carbon has some effect on the kind and number of the diamonds formed. The best results are obtained with substantially pure graphite. Other carbonaceous material, such as carbon black, sugar charcoal, or carburizing compound, may be used as the source of carbon, but graphite is preferred.

The catalyst metal can be chromium, manganese, iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium, or platinum. Tantalum is particularly effective for inducing the growth of small diamond crystals, although under some circumstances it may not be as active as the other catalysts.

The General Electric researchers also discovered that new diamond can form whether diamond seed crystals are present or not, and that the diamond can grow at very high rates. The formation of man-made industrial diamonds (80 mesh and finer) is completed within a few minutes.

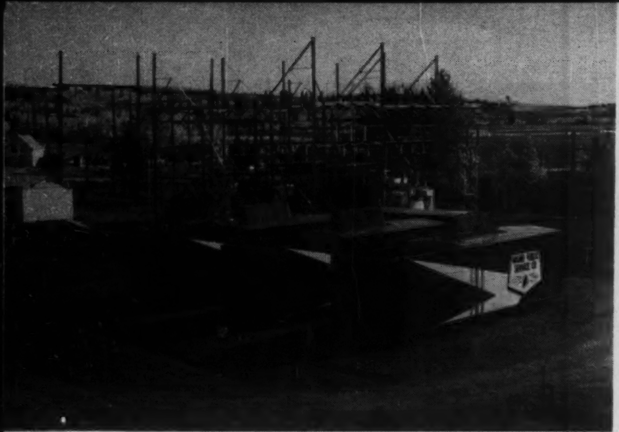
Of particular significance was the discovery that the shape of the diamond crystal varies according to the temperature of formation. Cubes predominate at the low end of the critical temperature range; mixed cubes, cubo-octahedra, and dodecahedra at the intermediate point; and octahedra at the upper limits of the range.

By controlling the shape and other characteristics of the diamonds it will be possible to tailor them more nearly to the requirements of industry for special cutting, grinding, and polishing applications.

Several devices were invented by the General Electric research group for sustaining the ultrahigh pressures and temperatures required to change carbon into diamond. One very successful device, called the "belt," makes use of conical, Carboloy cemented-carbide pistons that push into each end of a specially doughnut or "belt"-shaped Carboloy cemented-carbide chamber. The conical piston has much greater strength than the usual cylindrical piston of high-pressure equipment. Both chamber and pistons receive support on all sides from a doughnut-shaped structure consisting of several stressed binding rings, from which this device takes its name.

An important feature of the "belt" is its pressure sealing technique. In this technique, conical gaskets of pyrophyllite, a naturally occurring form of aluminum silicate, are used for the dual purpose of holding pressure and yet allowing motion through compression and flow. A unique characteristic of pyrophyllite is that its melting point is raised from 2400 to 4800 F by pressure. Pyrophyllite is also used to hold the sample, which consists of the graphite and the metal catalyst. The high temperature is obtained by the passage of electrical current through the sample. The pyrophyllite, in addition to transmitting the pressure of the converging pistons, serves as a thermal and electrical insulation, enabling the pistons to remain comparatively cool, thus increasing their effective strength and extending their useful life.

The making of diamonds is of particular significance as the first major achievement in the commercialization of a superpressure process.



Three separately housed 2000-kw diesel-engine-generator units and a control-and-switchgear unit make up the ready-to-operate easily transportable peak-power auxiliary plant

Peak-Load Power Plant

An automatic push-button-operated generating plant, developed and built by the Electro-Motive Division of General Motors (Mechanical Engineering, January, 1959, p. 48) has been installed at Maine Public Service Company's Flo's Inn Substation, 5 miles northeast of Presque Isle, Maine. The new plant went on the line at its full rated capacity of 4200 kw less than 90 sec after the company's central dispatcher in Presque Isle pushed remote-control buttons to automatically start the plant's three separately housed diesel-engine-generator units.

A study by Stone and Webster Service Corporation of the character of the company's load has indicated that the General Motors units were the most economic means of providing additional generating capacity for quick peaking and reserve.

The Maine Public Service load pattern is typical of the average utility in which approximately 20 per cent of the peak load is required about 2 per cent of the time.

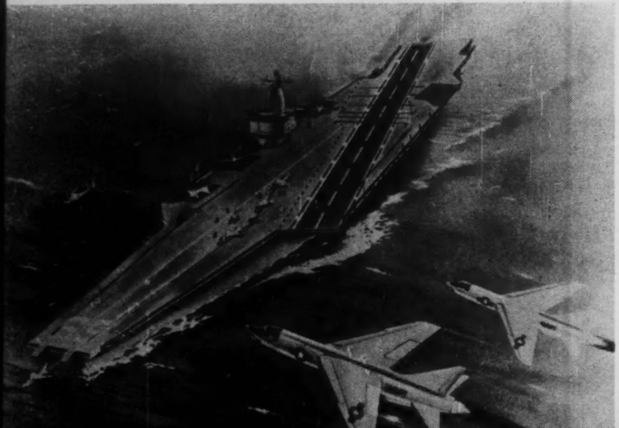
The equipment carries a fixed cost of approximately $15 per kw per yr as compared to about $28 per kw per yr for what has been considered conventional equipment for this type of work.

Nuclear Carrier "Enterprise"

The ship's turbines of the 1100-ft-long *Enterprise*, the largest aircraft carrier ever built and the longest ship afloat, will be powered by 32 steam generators receiving heat from eight pressurized-water nuclear reactors.

Each of the 86,000-ton ship's four propeller shafts will be driven by two reactors and the ship will have a speed of 35 knots. Each of the eight reactors is larger than those employed for submarines and develops 35,000 shp.

Eight pressurized-water nuclear reactors will power the 1100-ft-long **Enterprise,** the largest aircraft carrier ever built and the longest ship afloat



The carrier will have virtually unlimited steaming endurance and will be able to operate continuously at full power for five years without refueling. It has 4000 sq ft more flight-deck space than the largest carrier currently afloat and will be able to carry twice as much jet fuel.

Since nuclear-powered vessels do not require stacks, the carrier will be able to operate more efficiently in unfavorable weather. Advanced radar with two times the range of the best now in service can also be used.

A crew of 4000 will man the ship which is to be launched in July, 1960.

Westinghouse is the prime contractor for the nuclear portion of the vessel, designed under the direction of and in technical co-operation with the Naval Reactors Branch of the Atomic Energy Commission. The Foster Wheeler Corporation is one of the subcontractors.

In addition to the nuclear plant, Westinghouse has a $3-million contract to design and build four giant deck-edge elevators, each of which will be capable of lifting a 40-ton plane to the flight deck in a matter of 14 sec.

Two pressurized-water reactors in a land-based prototype plant at Idaho Falls, Ida., achieved operation in parallel at full power in September. Known as the A1W prototype, it is the nation's first nuclear power plant to have two reactors powering one propeller shaft and is the prototype plant for the guided-missile cruiser, *Long Beach*, as well as the *Enterprise*. The *Long Beach* will employ two of the reactors, the *Enterprise* eight.

The A1W is the largest naval nuclear power plant in operation and is housed in an exact replica of a ship's hull section along with all the primary coolant systems. Philip N. Ross, Mem. ASME, general manager of the Bettis atomic power laboratory, emphasized that the A1W prototype full-scale test of the reactor, reactor systems, steam-plant-systems apparatus and controls will provide important technical information on over-all plant performance.

The guided-missile cruiser *Long Beach* is being built by Bethlehem Shipbuilding Company, Quincy, Mass., and the aircraft carrier *Enterprise* is being built by the Newport News Shipbuilding and Dry Dock Company.

Push-Button Telephones

Telephone advertisements have been featuring a push-button system that may replace rotary dialing. The user would simply press buttons instead of turning a finger-wheel. In the electrical circuitry of the telephone is a transistor oscillator which generates a different coded pair of tones for each button. The invention of the transistor, announced by Bell Telephone Laboratories in 1948, is one of the advances which makes push-button signaling feasible.

Some of the steps necessary to complete the development of the device at Bell Labs and to integrate it into the present switching system—which nationwide comprises the world's largest computer—are described in the October, 1959, *Journal of the Franklin Institute*.

The tones produced when a button is depressed are audible and similar to those now heard in some localities when long-distance calls are made. This is, in effect, a new language, different from the pulsed code generated by the rotary dial. "Translators" are needed to adapt existing central offices and make the nationwide system bilingual. These have already been developed.

The manual operation of signaling with push buttons takes only a fraction of the time needed for dialing.

The average time for tapping out a seven-digit number is about 5 sec, although some can do it in less than 2 sec. Rotary dialing, by contrast, averages 9 sec.

The time taken for a push-button call to go through after the number has been signaled would depend on the type of switching system used in the locality. Where crossbar switching has been installed the time would be proportionately reduced. Where step-by-step switching systems operate, the number would be stored momentarily in a memory unit in the central office and the call would go through slightly faster than normal dialing.

Unexpectedly, it was found that a "snap" action did not produce any greater accuracy than a smooth button action did. Because most users were found also to favor buttons that depress with a very light, smooth pressure, engineers are accordingly developing switches that operate easily, yet are sturdy.

Americans of the push-button era, it was found, dislike a button that has a "tinny" sound when pushed all the way down, and most prefer a definite stop, slightly cushioned. A desirable button must also be large enough to display numbers and letters well. Yet accuracy is impaired when a button is too large a "target" at which to aim and punch. The best size turns out to be about half an inch square.

The buttons must also be spaced sufficiently so that users will not strike two at once, yet must be grouped closely enough so that all of the buttons can be seen at a glance—about a quarter inch apart.

Little Zipster

A ONE-PLACE helicopter that can cruise at 60 mph and refuel at any auto service station has been developed by Bensen Aircraft Corporation, Raleigh, N. C. It will sell for $6995 or be available in kit form for individual assembly at $980 to $4500 depending upon the amount of prefabrication done by the factory.

Company President Igor B. Bensen, Mem. ASME, has demonstrated that the Little Zipster can take off and land vertically with no ground roll, hover, fly forward, backward, or sideways.

Designed especially for off-airport flying, the versatile little craft is expected to expand the market for helicopters among ranchers, geological prospectors, foresters, transmission-line patrols; serve as a general aerial courier; and even break into the farm-equipment market.

Simplified design permits a correspondingly simple control system. The pilot has 360-deg visibility and faces a pair of handlebars suspended from above. Rotor lift and engine power are controlled by pulling and pushing the handlebars, and rudder pedals steer left and right.

The novel mounting of the airframe replaces the conventional swashplate mechanism, with all associated bellcranks and pushrods, with an improved "tilting-head" control developed by Bensen engineers. The airframe consists essentially of three straight aluminum tubes bolted together for quick disassembly and storage.

The 60-hp Mercury outboard engine, mounted behind the pilot, drives a short shaft which turns two coaxial counterrotating rotors. Since the rotors turn in opposite directions, there is no tendency for the cabin to spin in the opposite direction (torque), and no tail rotor is needed to compensate for the torque. This simplification reduces maintenance below that for an average automobile. The transmission was designed to have a life of 2000 hr between overhauls. Gross weight is 700 lb.

The Little Zipster is designed especially for off-airport flying at low cost and with ease of maintenance. Automobile gasoline mixed with oil is the fuel used for a 2-cycle 60-hp outboard engine.

On a tank of automobile gasoline mixed with oil, the Little Zipster can carry a pilot and full load of cargo over a distance of about 100 miles (equivalent to about 150 highway miles) at a cruising speed of 60 mph. This range can be doubled with the installation of an oversized fuel tank. Operating cost is about $5 per hr. A pilot-owner will be able to maintain the helicopter himself.

Ektalith Document Reproduction

A VERSATILE photographic system which can rapidly make inexpensive paper masters for offset reproduction, or a limited number of direct copies without using the offset process, will be placed on the market by the Eastman Kodak Company about January 1, 1960.

All types of documents from letters to engineering drawings—printed, typed, written, or drawn originals on opaque or translucent paper—can be reproduced.

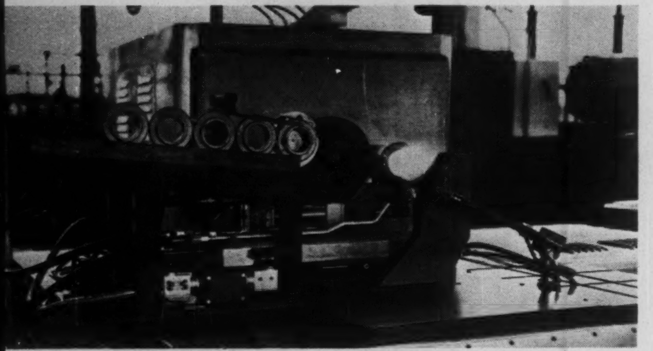
Three steps are required to make a master—exposing the original by optical means to a sheet of Kodak Ektalith Transfer Paper, processing it, and transferring the photo image to the paper master. The paper master is easy to correct and change. A moistened eraser or ink eradicator removes any excess details. Last-minute information may be added in handwriting or typing.

The master can be used to print up to 1000 or more copies on standard offset duplicating equipment, and as many as 2000 copies have been made in tests.

The Ektalith equipment line includes four table-top pieces, including three processors costing from $500 to $875. A loader-processor can make up to 10 × 15-in. masters in room light, or a standard copying camera can be used.

Copying, loading, and processing units for the Ektalith document-reproduction system which makes either offset masters or direct copies

The Cincinnati Intraform forms internal profiles, bonds laminated tubing, reduces and tapers solid or tube stock



The Flamatic flame-hardening machine has a rotating flame head for brazing together tiny instrument components or work hardening

The 12-in. Hydroform deep-drawing machine, in a chipless forming process produces hollow forms like that at the right in a single draw

Flamatic bore-hardened auto stator hub

The Hydrospin metal-spinning machine utilizes hydraulic pressure to power two opposed rollers that spin a workpiece to the contour and size of a revolving mandrel

CINCINNATI
Hydrospin

Hydrospun 54-in-diam missile engine-cage head

Machine-Tool Innovations

Cincinnati Milling Machine Company's recent 75th Anniversary was a full-panoply occasion for demonstrating the company's impressive family of machine tools. The latest addition to seven different numerically controlled machines, the Model S Borematic, made by Cincinnati's Worcester, Mass., associate, the Heald Machine Company, was announced at the celebration held in the Cincinnati, Ohio, plant. The company regards the size of its numerically controlled group of tools as an indication of the change in status of this production concept which is just 10 years old from "experimental" to "indispensable for many tasks."

Cincinnati's Meta-Dynamics Division represents an entirely different world of metalworking where controlled heat and controlled force are the tools of production. Flamatic machines use acetylene, propane, natural, or manufactured gas for brazing together tiny instrument components or hardening workpieces as diverse as hook rollers for a crane or cams for an electronic-data-processing machine. Inductron machines utilize an electrical field of 50,000 watts, oscillating at 1,200,000 cps, which surrounds the work, exciting the molecules into a heated state.

In chipless machining, Hydroform machines squeeze metal of foil to steel-plate thickness to the shape of a punch by means of a rubber blanket under accurately controlled hydraulic pressure. On Hydrospin machines, hydraulic pressure powers two opposed rollers that spin a workpiece, even when it is made of a high-tensile alloy, to the contour and size of a revolving mandrel. Rapidly revolving dies on an Intraform machine squeeze parts around a mandrel of the desired size and shape to form accurate profiles.

The company's new line of 33 building-block machine tools for electrical-discharge machining was recently introduced (Mechanical Engineering, October, 1959, p. 82), and the Telematic system of automatic-milling-machine cycle control has just been announced.

Koppers Blast Furnace

An ultrahigh-pressure blast furnace with a top pressure of 40 psi, or nearly four times that at any existing American blast furnace, has been developed by the Koppers Company, Inc., Engineering and Construction Division, and is ready for actual building.

Twice as much pig iron will be produced as in a furnace of comparable size operated at the normal pressure of about 2 psig. Thus the output of a blast furnace with a hearth diameter of 28 ft, now averaging perhaps 2000 tons per day at normal pressures, would be in the range of 4000 tons per day at 40-psig top pressure. To achieve this 100 per cent increase in production, an additional capital investment of only 20 to 25 per cent is required and labor costs are reduced 30 to 35 per cent.

A completely new installation is required rather than the addition of high-pressure equipment to an existing furnace, as has already been done with 20 American blast furnaces.

The new Koppers furnace differs from conventional blast furnaces in a number of ways: *(a)* The furnace itself, the hot-blast stoves, and other facilities must be constructed as pressure vessels; and stoves require special anchoring; *(b)* all parts of the high-pressure gas system are designed to provide insured sealing against even minute leakage; *(c)* capacity of blowing facilities is greatly expanded; *(d)* the high-pressure furnace does not employ the conventional blast-furnace charging system, and has eliminated the traditional large bell; *(e)* employment of the high gas pressure to clean the gas obviates the need for electrical precipitators; *(f)* doubled pig-iron output requires doubled cast-house facilities, including two tap holes, two mud guns, and duplicate runner systems.

"Dynatrol" Vertical Turret Lathes

The Bullard Company, Bridgeport, Conn., has developed a new series of fully power-controlled vertical turret lathes in nine sizes with table diameters ranging from 26 to 124 in.

These "Dynatrol" vertical turret lathes incorporate distinguishing advances in machine-tool design that make for greater production efficiency—keep the tool in the cut more of the time—cut the time between cuts—and increase the operating speed and production rate of the new lathes.

The first of these is a completely new single-lever control for positioning each of the heads, and for engaging or disengaging the tools from the work. The new system which replaces the conventional handwheel and toggle-lever system shortens this nonproductive portion of the operating cycle, makes these functions easier for the operator, and results in far more time for actual cutting.

The second is a provision for feed rates directly coupled to table rpm which are infinitely variable throughout the full range of the machine. This permits the new lathes to be run at all times at the optimum cutting rate for the kind of material and tool in use. Feed rate can also be varied while cutting, without stopping the table, allowing changes to be made to match changes in stock-removal conditions or to adjust for tool wear.

For the larger-sized machines, a remote-control system is provided. From a control pendant, the operator can regulate table movement, start, stop, or inching, and select table speed. The speed selected is visually indicated by a light at the appropriate position around a circular dial mounted at the right-hand end of the cross rail.

In addition, the heads are operated by a compact, lightweight, portable control box that fits into the operator's palm. By moving a single control lever to the left, the operator can traverse the head at any one of four traverse rates—9, 4, or 1 in. per min, and inching rate. The rate of traverse is varied automatically according to the distance the lever is moved from neutral.

The direction of traverse is regulated by pressing the appropriate directional button, corresponding to up, down, right, or left. Pressing two adjoining buttons simultaneously produces head movement at 45 deg.

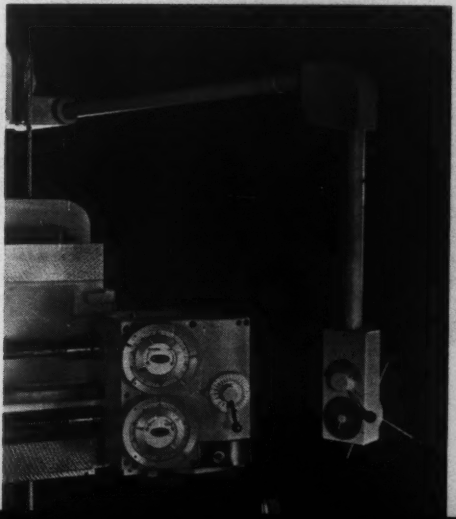
Large, easy-to-read, clock-type dials with dual pointers permit the operator to move the heads faster and with more confidence.

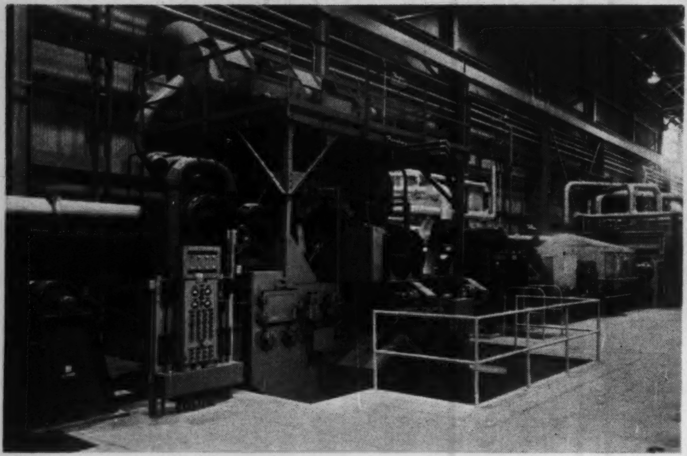
The Bullard Dynatrol vertical turret lathe has been designed for complete versatility, from the simplest, yet highly productive, manual operation ever devised to complete automation. This may be accomplished through the use of Bullard Man-Au-Trol for complete automatic operation or through point-to-point or continuous-path numerical-control systems.

Other accessories which can be applied include Size-Au-Trol for accurate positioning of all heads; contouring attachments either hydraulic, electronic, or electro-hydraulic; four or five-sided power-indexing turret heads; thread cutting, drum-scoring, and angle-turning attachment and power-operated chucks.

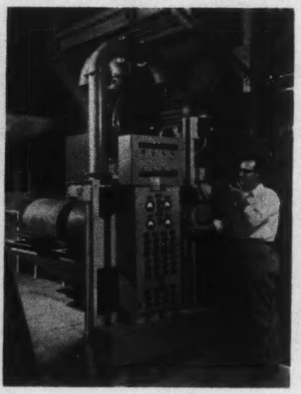
Dynatrol vertical turret lathes are fully power-controlled. A single lever positions each of the heads and engages or disengages tools from the work.

Clock-type dials with dual pointers measure accurately in thousandths of an inch and permit exact head positioning without the use of handwheels





Two strands of stainless steel move simultaneously through the Rotoblast automatic mechanical-descaling operation after reduction by rolling mills, annealing, and fog cooling. Only manual operation is the setting of the degree of blast.



Pushbutton control panel for the 659-ft processing line includes telephone communication with key points along the line

Blast Descaling

A special Rotoblast machine for descaling stainless-steel coils is helping Universal-Cyclops Steel Company keep processing costs under control in their new Coshocton, Ohio, plant. The shot-blast equipment manufactured by Pangborn Corporation, Hagerstown, Md., boasts several new features designed to provide a degree of flexibility not previously available.

The blast-descaling machine handles two strands of steel simultaneously. Individual strand control permits the coils to be processed through the descaling operation at different line speeds.

To provide additional flexibility, the position of the blast wheels can be changed at the touch of a push button on the control panel to offer the most effective targeting of both top and bottom blast streams for the particular widths of steel being processed at the time.

The velocity and volume of abrasive thrown, also, are easily variable. The Rotoblast wheels are equipped with two-speed, constant-torque motors—50 hp at 1200 rpm or 75 hp at 1800 rpm—and automatic orifice control.

The blast-descaling equipment is located approximately in the center of Universal-Cyclops' 659-ft fully automatic intermediate anneal and pickle line. It are designed to mechanically descale 300 and 400 series stainless coils 0.040 and thicker, prior to pickling—to speed production and cut costs.

The material brought in from other facilities is uncoiled and passed through rolling mills (for reduction), annealing furnaces, fog cooling, blast descaling, pickling (two electrolytic and one acid bath), inspection, and recoiling.

The entire line is continuous and automatically controlled and requires no operator for the Rotoblast machine. The two strands of steel pass simultaneously through the blast machine and are continuously descaled, top and bottom, at line speeds ranging up to 80 lineal fpm. Since line speeds are determined by the requirements of annealing operation, the shot-blast machine needs only four wheels for thorough descaling of both sides at the maximum speed of the lines.

Rotoblast Steel Shot in Sizes S-70 and S-110 is the abrasive used. Effective abrasive cleaning and recycling equipment is built integrally with the machine so abrasive can be used over and over again.

30 Million Words a Second

Several electronic devices capable of handling information at the rate of 30 million words a second were reported by Sperry Gyroscope Company's Peter J. Isaacs, head of the digital-computer research, at a meeting of the IRE Professional Group on Electronic Computers. At this rate, all of the news material in 200 daily newspapers the size of the *New York Times* could be transmitted in less than one second.

The new devices were created for the purpose of developing computers and communications systems capable of handling large amounts of information at speeds at least 1000 times faster than large electronic computers currently in use.

A special communications system could be developed in which a message of say 30 words, such as a telegram, could be transmitted in a millionth of a second on a single radar pulse.

Another possibility is in a data-reduction system involving simple operations like correlating and counting, such as in scientific experiments in nuclear physics where billions of events occur in an extremely short space of time.

A microwave diode switch capable of switching 700,000,000 bits of information a second uses hollow pipes as conductors in place of conventional wires because it employs 10,000-megacycle alternating energy rather than the standard d-c electric currents used at present.

Another component is a new microwave amplifier tube which can perform logic operations at the rate of 1,000,000,000 times a second.

Fish-Scale Concrete

Fish scales are being used by Mearl Manufacturing Corporation to make a foaming additive for concrete mixes. The foam, called "Mearlcrete," is made from protein-rich fish scales mixed with special chemicals, adding polyglycols for improved stability.

The fish-scale-foamed concrete is indeed versatile. Its density can be varied from 10 to 120 lb per cu ft; it can be pumped 250 ft vertically or 900 ft horizontally; reduced capillarity is a barrier against moisture penetration; it is a fine insulating material; and it is fast drying.

Pyrographite for 6700 F

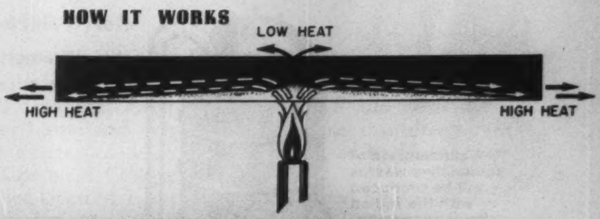
Pyrographite, a high-purity form of graphite or carbon, that withstands temperatures up to 6700 F, higher than any other known element, has been brought into practical commercial production by the Raytheon Company, Waltham, Mass. Moreover, pyrographite at these high temperatures remains strong, chemically inert, and impermeable to gases.

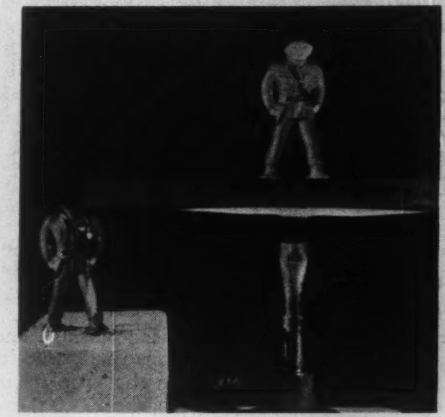
Key to the heat-handling ability of this material is the peculiar property that allows it to conduct heat 500 times better along the surface than through it. In fact, along the surface pyrographite is superior even to copper or silver as a heat conductor. This surface conductability is useful in preventing the development of undesirable hot areas.

In industrial use, the new material has advantages for nuclear-reactor use where ordinary graphite now serves as a moderator; also in dozens of other applications where high-temperature thermal insulators are urgently needed.

Continued investigation by Raytheon researchers is expected to add several new potential marketing avenues.

For example, pyrographite can be made as fibers for thermal insulation and plastic strengthening. By adding metals, special alloys can be tailor-made for industrial needs.





Heat flows 500 times faster along the surface of Pyrographite than through it, melting the head off of the lead figure at left, while figure above the material is relatively unaffected. Pyrographite withstands 6700 F, higher than any other known element.

* * *

"Recomp II" Computer

A general-purpose, all-transistor, single-address, digital computer, Recomp II, being built by North American Aviation's Autonetics Division, solves problems of extreme complexity although it occupies only the area of an office desk and a two-drawer filing cabinet. Operation is fast and simple and can be learned by an inexperienced operator in a single day.

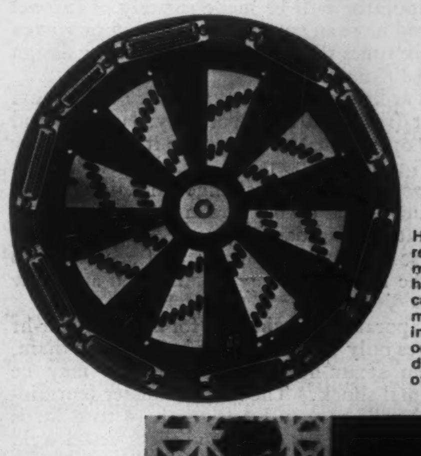
Additions are performed at 1852 per sec, fixed-point multiplication in 10.8 millisec, and floating-point multiplication in 12.5 millisec.

Input-output flexibility is achieved by easy-to-learn devices including transfer switches, electric typewriter, punched paper tape, and a minimum of other controls. Data can be verified immediately, and discrepancies will cause the process to be stopped and error lights to show.

The readout panel expedites operation by flashing arabic numerals to reveal contents of any word or register. Control switches start the computer in prescribed locations, and an electric 10-key manual board simplifies input.

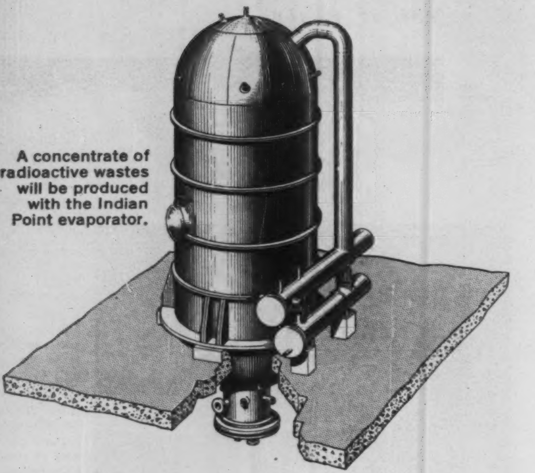
The compact, high-capacity, magnetic-disk memory of Recomp II contains 4096 words each of 40-bit length including 16 words placed in high-speed loops. Five rapidly circulating 1-word registers perform arithemetic and logical operations. Each word in the memory holds up to a 12-decimal digit number, 8 alpha characters, or program instructions. Recomp II can retain over 8000 instructions at a time, or will store over 49,000 decimal digits of data.

Some of the mechanical-engineering uses include load and stress calculations for bearings, structural members, and piping systems; heat-exchanger design, hydraulic systems, machine-tool design, numerical control of machine tools, and process control.



High-speed rotary-disk memory has 4096-word capacity, can retain more than 8000 instructions or store 49,000 decimal digits of information

Recomp II, a general-purpose, all-transistor, single-address, digital computer which can handle extremely complex problems, occupies only the area of an office desk and filing cabinet



A concentrate of radioactive wastes will be produced with the Indian Point evaporator.

Nuclear Briefs

▶ Evaporator Solves Indian-Point Waste Disposal

A NEW evaporator designed by Chicago Bridge and Iron Company, and currently under construction at its Greenville, Pa., shops will help solve the problem of concentrating radioactive wastes when the 275,000-kw Indian Point nuclear power plant of Consolidated Edison Company of New York, Inc., goes into service in April, 1961. The evaporator will be made entirely of Inconel (nickel alloy) and have an entrainment section of woven stainless steel six times the usual thickness. The design calls for a welded flangeless unit.

The unit will accept wash-down and purge water from the entire plant (reactor area, laboratory, laundry, and filter-backwash operations) and vaporize it so effectively that less than 5 parts in 100 million of dissolved solids are in the discharge. An ion-exchange unit will cut this minuscule amount to less than 1 part in 100 million.

The concentrate of radioactive wastes—up to 30 per cent dissolved solids—will be disposed of according to procedures of the Atomic Energy Commission and New York State.

The CB&I evaporator is engineered for a 6000 lb-per-hr boil off, measures only 19 ft in height by $6^{1}/_{2}$ ft in diam, and has hairpin steam-heating loops which may be cleaned by thermal shock. The mesh demister (entrainment separator) will be a full 3 ft thick (4 to 6 in. is generally used in refinery practice), and every vessel weld will be completely inspected radiographically.

Built to the ASME Boiler and Pressure Vessel Code, the unit has been rated by Consolidated Edison as a primary vessel because the evaporator will handle water which has been used in the primary loop of the reactor steam-generating plant. The unit concentrates all material requiring evaporation that leaves the plant.

It operates on steam at 250 psi max and will never have to sustain internal pressure over 50 psi.

▶ Argonne Fast-Source Reactor Goes Critical

The Argonne Fast Source Reactor, AFSR, an air-cooled U-235-fueled irregular-octagon-shaped reactor, that will be used as a neutron source for developing experimental techniques for instrumentation and for reactor-physics studies for fast reactors, recently went critical at the National Reactor Testing Station, near Idaho Falls, Ida. Control mechanism for the 14-ft-across, $8^{1}/_{2}$-ft-above-floor-level reactor are located in a pit extending 10 ft below floor level. A cylindrical core containing nickel-canned thin-disk-shaped fuel elements is divided into a fixed upper section and a movable lower part which are brought together to achieve criticality.

▶ Portable Nuclear Power Plant for Air Force

A portable 9.3-tmw nuclear power plant with an output of 1000 ekw plus 7 million Btu per hr of process steam will be prefabricated for the Air Force by the Nuclear Division of The Martin Company, Baltimore, Md. Transportable by C-130A aircraft, the reactor will be made up of "packages" limited to 15 tons and no larger than 8 ft 8 in. sq and 30 ft long. About 1 dozen packages will be required for the advanced-pressurized-water design which will use tubular Materials-Testing-Reactor-type fuel elements.

Miniaturized solid-state components will be used in the fail-safe control system. Heat from the pressurized water flowing through and around the tubes will be transferred to a secondary loop where water at normal pressure will be converted to steam to drive a conventional turbogenerator. When turned over to Air Force crews at Sundance, Wyo., in 1962, the electricity will power electronic equipment and the process steam will heat the building.

▶ Swedish Nuclear Reactors

A group of Swedish power companies, Atomkraftkonsortiet, AKK, according to the November, 1959, *Forum Memo* of the Atomic Industrial Forum, Inc., has requested a government license to build by 1965 a 50 to 100-emw, natural-circulation, boiling-light-water, enriched-uranium (1.8 per cent) power reactor on the Simpevarp peninsula in Misterhult in the province of Smaland in southeastern Sweden.

Proposals on a turnkey basis have been requested from Nydqvist and Holm-ASEA representing the U. S.'s General Electric Company and the Johnson Group representing Westinghouse Electric Corporation.

AKK reportedly hopes the plant will provide power competitive with conventional power in the region. No financial support is being sought from the Swedish government, but the group said the State Power Board has expressed interest in participating in the project.

Another Swedish reactor project is the R-4 (Eve) reactor which is being designed in the 100 to 200-emw range. It will be of the pressurized-water type, using natural uranium, with heavy water as moderator and coolant. The semipublic Atomic Energy Company and and the State Power Board have joint responsibility, with the latter providing the funds. ASEA and Nydqvist and Holm are participating in design studies; construction schedule and site (expected to be in the province of Närke west of Stockholm) have not yet been announced.

Sweden's R-3 (Adam) 1.5-emw and 70-tmw plant which will produce space heat for dwellings is scheduled for operation in 1963.

▶ Second Major Nuclear Research Center for Canada

Startup of a second major Canadian nuclear research center is expected in about two years. It will be erected on a site in the Province of Manitoba, to be selected late this winter. According to an item in a recent issue of *Chemical and Engineering News*, an organic-cooled heavy-water-moderated power reactor, fueled with natural uranium will be included. The facility is to be built by Atomic Energy of Canada, Ltd., the government-owned company which operates Canada's other nuclear research center at Chalk River, Ontario.

▶ Industry Views on Process-Heat Reactors

A questionnaire completed by 67 of the 200 industry representatives and others, attending a recent symposium on process-heat reactors sponsored by the Atomic Energy Commission, indicated that they favored further development of process-heat reactors which would produce steam at up to 600 psi at a rate of 100,000 to 250,000 lb per hr.

Most of those answering the questions would expect the nuclear reactor to be used in industrial processes for normal steam production, and conventional steam plants to be used for stand-by purposes or to meet peak loads. Preference was expressed for developing such reactors as co-operative projects between the AEC and industry, with the AEC taking the lead and providing the necessary research and development assistance, and industry contributing to construction costs.

Of the responses to the questionnaire, 26 were by present or potential users of process heat, 18 from constructors and/or engineers, 17 were reactor or reactor-components manufacturers, and seven represented other types of organizations.

▶ Mercury-Vapor Turbine Driven by SNAP Reactor

Another in the series of Systems for Nuclear Auxiliary Power, SNAP, being developed for the AEC program to provide auxiliary electrical power in space vehicles has been test operated. Designated the SNAP Experimental Reactor, it follows the concept of SNAP II. It is fueled with enriched uranium, weighs 220 lb without shielding, and produces 3 ekw. In an operational device, heat from the reactor, which was designed and constructed for the AEC by Atomics International, a division of North American Aviation, Inc., Canoga Park, Calif., would be transferred by a liquid-sodium coolant to a boiler containing mercury.

The mercury vapor would be directed into a miniature turbine. Except for the mercury vapor, the system would operate on the same principle as an ordinary steam-electric generator. Such a conversion system has been developed and successfully operated at design conditions with an electrical heat source. The components of the power-conversion system were developed by Thompson Ramo Wooldridge, Inc., Cleveland, Ohio.

The objective of the SNAP reactor program is to provide devices which will generate many kilowatts of electrical energy for a minimum period of one year in space and which will weigh no more than a few hundred pounds. Several hundred thousand pounds of chemical batteries would be required to produce the electrical-energy objective of SNAP II. The device must be capable of withstanding the shocks and vibrations of a missile launch, must be capable of unattended, reliable, and automatic operation in a space environment, and must not present a radiation hazard. Such a device would make possible long-lived weather satellites, world-wide TV communications, deep-space information transmission, and eventually interplanetary travel.

SNAP III, developed by The Martin Company of Baltimore, Md., was announced earlier by the White House (MECHANICAL ENGINEERING, March, 1959, p. 80).

Materials Briefs

▶ Hydraulic Fluid for Low-Temperature Use

WATER-BASED, fire-resistant hydraulic fluid with operational capability from −35 to +160 F and with satisfactory liquid-and-vapor-phase corrosion inhibition over this temperature range is being produced by Union Carbide Chemical Company.

Called Ucon M-1, the newly introduced hydraulic fluid has resistance to spray flammability in 100 per cent oxygen atmosphere with an electric-arc ignition source (the Factory Mutual test), and resistance to at least a 300 ft-lb detonating force in the presence of liquid oxygen (Reaction Motors, Inc., impact test). There is adequate lubricity for rotary-vane and axial piston pumps.

Though developed for military use, Ucon hydraulic fluid M-1, with its exceptional low-temperature properties, has potential commercial use for equipment operating in extreme cold.

▶ Nylon Pressure Tubing for Flexible Hydraulic Lines

Specially processed polyamide tubing called Type H Nylaflow pressure tubing has been made by the Polymer Corporation, Reading. Pa. The manufacturer states that it has a short time burst-pressure rating of 2500 psi under normal condition. The tubing cuts system cost and solves flexible-hydraulic line problems for hydraulically controlled machinery.

It provides better than a 5-to-1 safety factor for long-term 450 to 500-psi pressure applications.

▶ Glow "Dating" of Fired Materials

Although industrial applications are not described another method of determining the age of materials has been discovered. G. C. Kennedy of the University of California, who proposed the method for establishing time lapse, calls it thermoluminescence.

As described in *Product Engineering* for November 2, 1959, a previously fired object (man-made or volcanic in origin) will glow when heated. By measuring its light glow, objects at least $^{1}/_{2}$ million years old can be "dated," and it may be possible to extend the technique to 2 million yr. The lower limit of age determination is not given in the article.

The object is heated to 800 F and its glow is detected and measured with the aid of a photomultiplier tube. At the same time, the mean radioactivity is measured. By combining the two figures, the number of years since the object was last heated is obtained (age of material equals glow divided by mean radioactivity).

▶ Heat Shield for 3000 F

A heat shield, made of laminated glass fiber and resin, which endures catastropic temperatures of 3000 F and withstands the battering of submeteoric particles, has been produced by B. F. Goodrich Aviation Products, a division of The B. F. Goodrich Company.

It provides its own heat barrier for space flights through planned, controlled deterioration of the surface into gases and molten liquids under the influence of intense heat. That is, heat is drawn off and dissipated away from the capsule by the melting and by the stripping off of ablation.

Re-entry shields varying from $^{1}/_{4}$ in. to 6 in. thick depending on the velocity, angle of the vehicle's re-entry, and on the aerodynamic design of the vehicle have been produced.

PHOTO BRIEFS

1 Welding Positioner. At the Allis-Chalmers shops, this runner for the dam at Fort Peck—the largest earth-filled dam in the world—is being welded on the largest welding-positioning table in the Western Hemisphere. The runner is for one of two 63,500-hp, 128.6-rpm, 170-ft-head hydraulic turbines.

2 SABER. That's American Airline's code name for its new IBM computer system for passenger reservations, expected to bring to reservations service as dramatic an improvement as the jet is bringing to the flight. SABER will offer all seats for all flights instantly, on a first-come, first-served basis to all cities served by American. The computer center maintains a complete up-to-the-second record of every American flight, seat inventory, and a complete file of passengers' names and other data. The picture shows a prototype agent's set. Those boxes contain 20,000 tickets, part of one day's requirements.

3 Supersonic Wind Tunnel. Boeing Airplane Company at Wichita, Kan., uses this supersonic wind tunnel in Mach 2 to 4 testing of such projects as external ramjet combustion studies in supersonic flow fields and development of supersonic inlets for future aircraft engines. The tunnel has a 9-in. by 9-in. test section and a variable-orifice throat.

4 Portable Fathometer. What depth have you got? Raytheon's DE-708 fathometer, with transistorized depth sounder, operates from its own mercury battery, or from 12-v, d-c power supplies. It weighs five lb and indicates depths of water from 2 to 120 ft. It can be portable, or permanently installed.

5 Tree Crusher. Prototype of the "Modern Pioneer," this monster is designed to smash unproductive scrub forests, preparing the land for conversion into pastures, tree farming, reservoirs. R. G. LeTourneau, Incorporated, of Longview, Texas, say their new "G-40" will smash between three and four acres per hr, at $3.50 per acre.

6 Roll Clamp. Lift that 7000-lb roll: Lift it, lower it, rotate it 360 deg. Towmotor Corporation of Cleveland, Ohio, offers this accessory to their fork-lift trucks. Many parts are of Jalloy, a high-strength alloy plate from Jones & Laughlin Steel Corporation—saving 20 per cent in weight.

7 Flying-Spot Store. In this Bell Telephone memory system, "memory film" is scanned by a beam which is generated by a cathode-ray tube and focused by a system of lenses. The flying spot can read out a 68-bit word (68 spots simultaneously) every $2^1/_2$ microsec. The "store" is to be the permanent memory for an experimental electronic telephone switching system.

Commuter Express.
Model of a space ferry by Hughes and Lockheed, designed to shuttle men and materials between earth and space stations

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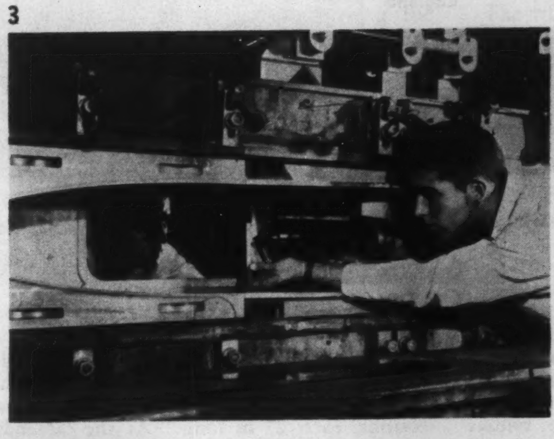

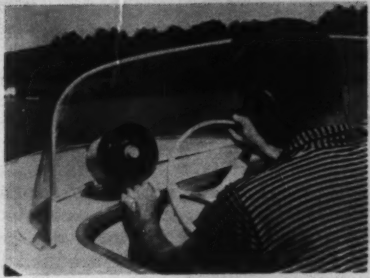

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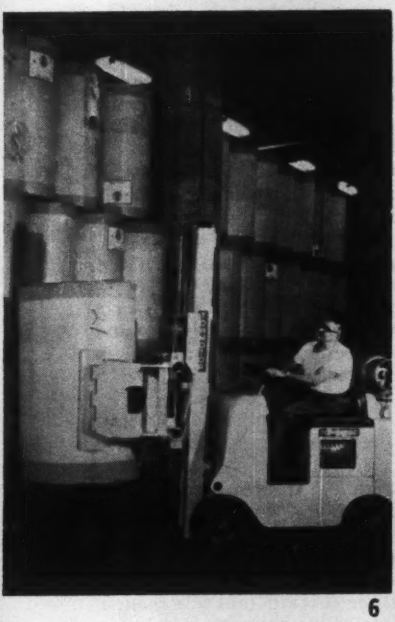

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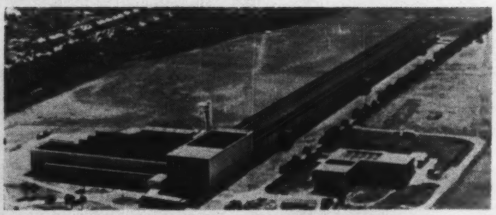
Engineering
Progress in the
British Isles and
Western Europe

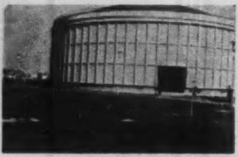
EUROPEAN SURVEY

J. FOSTER PETREE
European
Correspondent

England



Yugoslavia



Denmark

Three New Ship Model Basins

Since in 1872 William Froude constructed the first ship model towing tank at Chelston Cross, near Torquay, England, the value of this method of experiment as a means of determining the power required to produce a given performance has been more and more widely recognized, though the number of tanks in the world remained small until well into the 20th century.

The advent of improved methods of measurement and control within the past 20 years or so has led to a great increase in their number, but never at such a rate as in 1959, which has seen no fewer than three new basins of large size brought into use.

The first of these in sequence was at Lyngby, near Copenhagen, Denmark, where a new Hydrodynamics and Aerodynamics Laboratory has been opened. The second was at Zagreb, in Yugoslavia, at the new Shipbuilding Research Institute; and the third is the Ship Hydrodynamics Laboratory of the National Physical Laboratory at Feltham, Middlesex, England, opened on October 19th.

When it is remembered that, in addition, considerable extensions and developments have been undertaken in recent years at several of the existing basins—for example, the Netherlands Tank at Wageningen, Holland, has been lengthened, and the British Admiralty's establishment at Haslar, near Portsmouth, England, has received a great deal of new equipment—it will be seen how great is the importance now attached to this branch of scientific investigation. There are now more than 30 model basins in regular use, apart from those in Russia, of which no precise details appear to be available.

Denmark. The Lyngby tank is the realization of a project that had been in the minds of Danish shipping technicians for many years and has been constructed in part with government funds, partly at the cost of the shipping and shipbuilding industries, and in part with the aid of private contributions. Work began on the site north of Copenhagen in 1956, and the establishment was formally opened on May 4, 1959, Denmark's Liberation Day.

The basin is 240 m long, 12 m wide, and has a depth of water of 5.5 m; it is constructed of prestressed-concrete sections, each 27 m long. At the far end the bottom slopes up to provide a wave-absorbing beach. The carriage is built of steel tube and is supported on four bogies, each driven by a 40-hp d-c motor.

The top speed is about 14 m per sec. Electronic speed regulation enables the carriage to be run at preset speeds, which are automatically recorded. Most of the electronic equipment is of Danish design, but the electronic propeller dynamometers, while constructed in Denmark, were made to drawings and specifications made available by the David Taylor Model Basin.

A Fibreglass model is used for checking the instruments; this is of British Standard design and is the first of its kind to be delivered outside of Britain.

The wavemaker is of the pneumatic type and is of a new design developed in Denmark; air is supplied to and exhausted from a wave chamber by a single axial-flow blower which has reversible blades so that it can switch from blowing to exhausting to give the necessary pulses.

Yugoslavia. Though Yugoslavia's shipbuilding output is not large, it is of a good quality, and the possibilities of expansion offered by the transfer of former naval yards to merchant ships, coupled with the desire to train more naval architects to man the growing industry, led to a government decision in 1948 to establish a Shipbuilding Research Institute. Construction began in 1952, and has taken six years, but in view of the size of the undertaking, which comprises three towing tanks, a maneuvering tank, and two cavitation tunnels, in addition to workshops, laboratories, and offices, this is not surprising.

The main tank, used for resistance tests and self-propelled models, has a length of 276.3 m, a width of 12.5 m, and a depth of water of 6.2 m. It is of reinforced concrete, made in ten sections 26.2 m long and partly sunk in the ground, the bottom being about 10 ft below ground level. It rests on a bed of firm river

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gravel. The carriage is driven from one side only and on the driven side is fitted with guide wheels running on the sides of the rails to prevent cross-winding. The maximum speed is 12 m per sec.

There are four systems of braking—by regeneration, by two independent sets of air brakes, one acting on brake drums and the other on the rails, and by emergency friction brakes on the last 35 m of the run, acting on a separate brake rail. The measuring equipment on this and the other tanks was supplied by Kempf & Remmers, of Hamburg, Germany.

The high-speed tank has a length of 302.5 m, a width of 5 m, and a water depth of 3.15 m. It can be fitted with a false bottom of precast-concrete units, reducing the depth of water to 2.15 m, and has a maximum carriage speed of 20 m per sec. The small towing tank is 3 m wide and 2.5 m deep and has a straight towing length of 66.6 m. It is arranged tangentially to the circular maneuvering tank, so can be used to accelerate models into the circular basin for steering trials. The towing carriage of the small tank does not span it, but runs along one side. This small tank has a plunger-type wavemaker.

The maneuvering tank is an unusual structure, the building having a reinforced-concrete frame with brick-filled panels, and a wooden domed roof, 128 ft in diam, covered with copper sheet. The tank itself has a diam of 32.02 m and a depth of water of 2.5 m. In the center is mounted a rotating arm with a radius of 12 m, which can reach a maximum circumferential velocity of 8.4 m per sec. In the center of the dome is a platform from which models can be filmed.

England. The new laboratory at Feltham, England, contains a towing tank 1300 ft long, 48 ft wide, and 25 ft deep; a cavitation tunnel with a measuring section 44 in. in diam; a sea-keeping and maneuvering basin 100 ft sq; and a vibration laboratory, workshops, instrument laboratories, and such. It forms part of the Ship Division of the National Physical Laboratory at Teddington, which already had two towing tanks and a small water tunnel.

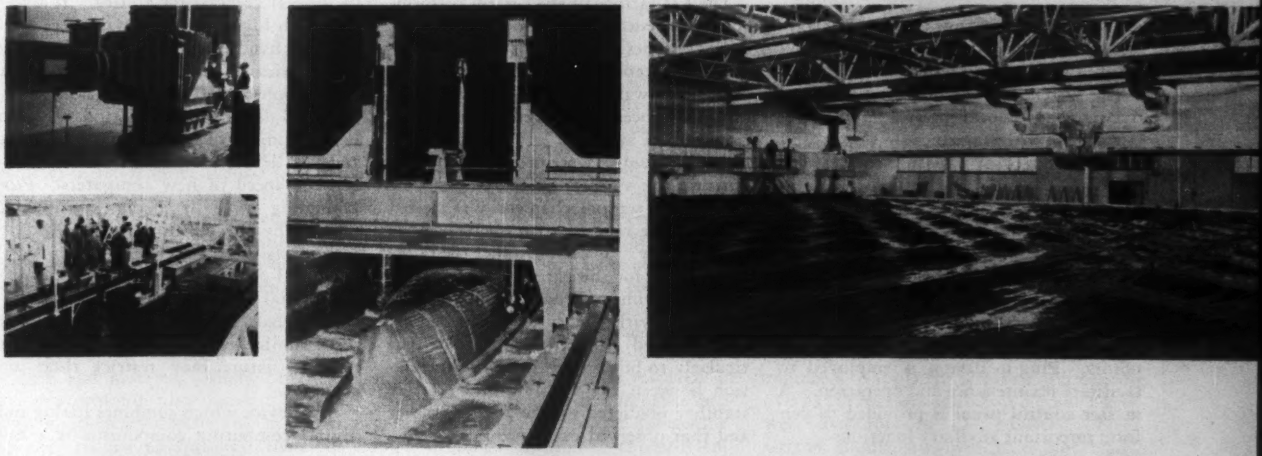
The towing carriage on the main tank is designed to tow models up to 40 ft long and 5 tons weight, and is mounted on four two-wheeled bogies, each driven by a 300-hp d-c motor. The maximum speed is 50 fps. The carriage runs on specially rolled rails weighing 260 lb per yd. They were rolled in 30-ft lengths which were then stress-relieved in a vertical gun-barrel furnace and Thermit-welded into 60-ft lengths. These were similarly welded on site into a continuous rail and the joints machined. The track follows the curvature of the Earth's surface, this curvature and its straightness being within a tolerance of ±0.005 in. over the whole length of 1300 ft.

The wavemaker is a wedge-shaped plunger of the full width of the tank, 7 ft wide at the top and 17 ft vertically; it weighs 20 tons and is actuated by hydraulic rams, controlled by an electronic-hydraulic servomechanism. It will generate waves up to 2 ft high and 40 ft long, crest to crest.

The cavitation tunnel is one of the largest in existence and is designed to take model propellers up to 24-in. diam. The maximum water velocity in the working section is 50 fps. The pressure and the air content of the water can be varied, as well as the water velocity. The U-shaped lower part of the tunnel descends 180 ft into the ground; in this section (known as the "resorber") the bubbles created by cavitation at the propeller are reabsorbed into the water. The water is circulated by a 92-in. vertical variable-pitch pump, driven at 220 rpm max by an 850-hp d-c motor supplied by a Ward-Leonard set. It will hold a preset speed automatically within 0.1 per cent. The propellers under test are driven by a dynamometer motor of 300 hp, with a high speed range.

The maneuvering basin is adjacent to the main tank and is 8 ft deep. It is divided into two sections by a reinforced-concrete wall, one section being for steering tests and the other being a store for ship models. Radio control is provided for steering the models under test, and a wavemaker is fitted for tests of sea-keeping qualities.

Value of the towing tank in determining the power required to produce a given performance in ships has become more widely recognized. Three new ship model basins have been constructed in England, Denmark, and Yugoslavia. Experimental equipment from each of these facilities are shown below. Towing carriage with a self-propelled model, **top left,** and working section of water tunnel, **bottom left,** at Zagreb (Yugoslavia) Ship Research Institute. Shaping machine for model hulls, **center,** at the Lyngby Tank, Copenhagen, Denmark. **At right,** sea-keeping experiment tank with wavemaker in action at the New Ship Hydrodynamics Laboratory, Feltham, Middlesex, England.



Substance in
Brief of Papers
Presented at
ASME Meetings

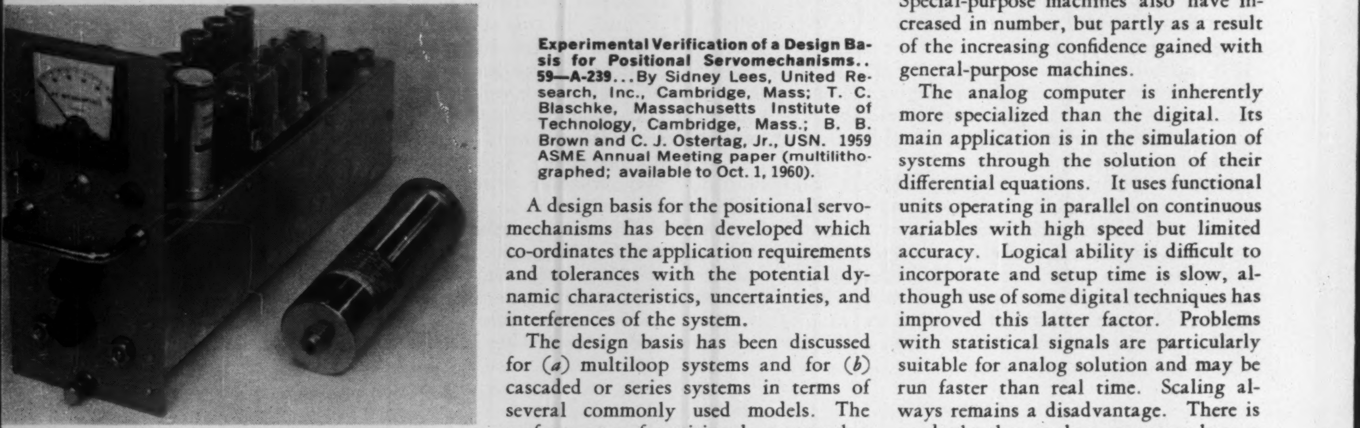
M. ZANFARDINO
Staff Editor

ASME TECHNICAL DIGEST

Instruments and Regulators

A Multipoint Electronic Manometer System for Low-Pressure Hypersonic Wind Tunnels..59—A-217...By P. L. Vitkus, NRC Equipment Corporation, Newton Highlands, Mass. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

A new multipoint electronic manometer system employing the radioactive-ionization-gage principle has been developed for use in wind tunnels.



Components of a single pressure-measuring channel of a multipoint electronic manometer system which uses the radioactive-ionization-gage principle (59—A-217)

The system has the advantages of: (*a*) Accurate and linear pressure-output relationship; (*b*) ruggedness in that it will not be damaged by exposure to pressures up to 150 psig; (*c*) fast response in comparison to the tubing response of the pressure system.

A disadvantage is that care must be taken to avoid mishandling of the radioactive sensing heads.

The largest system under construction will measure pressures at 50 different points. Plug-in design is employed to facilitate maintenance and operation. A master control panel is provided to per form important auxiliary functions.

Several output voltages are available to match the needs of specific readout devices.

Use of the multi-channel system will permit rapid assimilation and reduction of pressure data and promises to be a useful instrument in wind-tunnel aerodynamic investigations.

Experimental Verification of a Design Basis for Positional Servomechanisms.. 59—A-239...By Sidney Lees, United Research, Inc., Cambridge, Mass; T. C. Blaschke, Massachusetts Institute of Technology, Cambridge, Mass.; B. B. Brown and C. J. Ostertag, Jr., USN. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

A design basis for the positional servomechanisms has been developed which co-ordinates the application requirements and tolerances with the potential dynamic characteristics, uncertainties, and interferences of the system.

The design basis has been discussed for (*a*) multiloop systems and for (*b*) cascaded or series systems in terms of several commonly used models. The performance of positional servomechanisms is discussed in terms of the torques acting on the controlled member and in the manner by which they are generated.

The limitations of the system performance are distinguished from component characteristics.

The concept of frequency-dependent coefficients was introduced to clarify the physical processes engaged in the operation of these systems.

Analog studies were presented to demonstrate the validity of the basis. The instrument servomechanism was tested for the same ranges of parameters as the analog study. In each instance the range was 10 to 1 for the parameter.

The experimental results compare quite favorably with theory as illustrated by the included comparison charts. Particularly to be noted is the close correlation between the absolute and relative stability predicted by the analog studies and that observed experimentally.

Requirements for a Hybrid Analog-Digital Computer..59—A-304...By D. C. Baxter, Assoc. Mem. ASME, and J. H. Milsum, National Research Council, Ottawa, Canada. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

Electronic computers have reached their present wide acceptance because of their general-purpose capabilities. Special-purpose machines also have increased in number, but partly as a result of the increasing confidence gained with general-purpose machines.

The analog computer is inherently more specialized than the digital. Its main application is in the simulation of systems through the solution of their differential equations. It uses functional units operating in parallel on continuous variables with high speed but limited accuracy. Logical ability is difficult to incorporate and setup time is slow, although use of some digital techniques has improved this latter factor. Problems with statistical signals are particularly suitable for analog solution and may be run faster than real time. Scaling always remains a disadvantage. There is no doubt that analog computers have a continuing place in engineering design and development.

The digital computer is unchallenged in general calculating ability. It operates with high accuracy on discrete data and can handle any problem reduceable to a series of arithmetic steps. Such applications as pattern recognition, learning, and language translation are also being studied. Faster memory elements and paralleling of operations are increasing the speed of new computers. Programming time is being continually reduced by the use of automatic coding techniques.

Digital differential analyzers solve differential equations with greater accuracy than the analog computer, but with similar ease of use. Their special-purpose nature may restrict their acceptance.

Any device which combines analog and digital computing components is a hybrid computer, and many of these already exist.

Frequently digital devices are added to what is basically an analog simulation; for example, in time delay or multivariable-function generation. In other cases a hybrid has been naturally used in simulation of systems where a digital control system will be part of the final configuration.

The combination of the two separate techniques into one machine inevitably introduces extra cost and complexity.

There are special-purpose applications which show an advantage to the union, but it is unlikely that a completely general hybrid computer will be economically justified and successfully marketed.

Application of a Portable Spectroscope to the Rapid Identification of Alloy Steels..59—A-56... By D. R. Stoss and P. E. Sherman, Mem. ASME, General Electric Company, Schenectady, N. Y. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

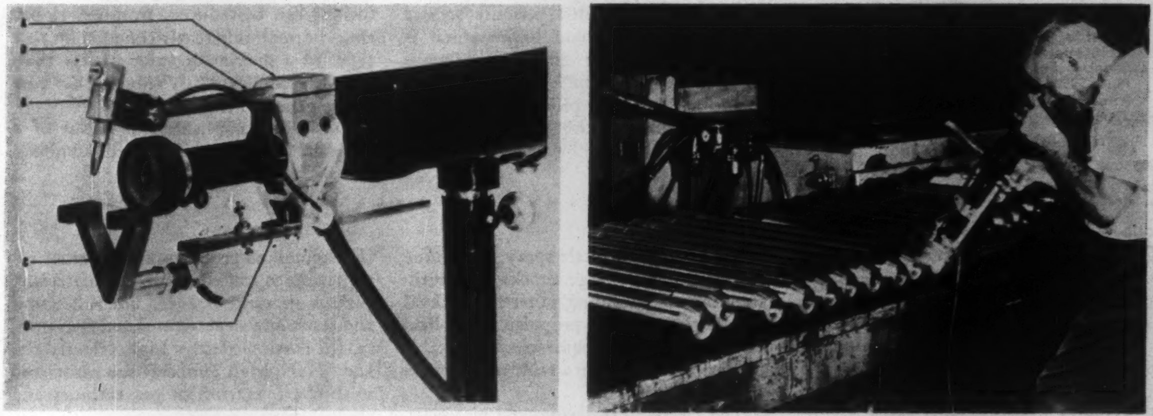
High-temperature, high-pressure steam turbines require the application of alloy steels in the sections of the turbine exposed to the effects of superheated steam up to 1200 F. The materials used in these sections are alloyed to impart high-temperature strengths several times greater than the materials used in lower temperature sections. If a low-strength alloy were used inadvertently in a high-temperature region, it could shorten the service life of these parts.

For example, the incorrect material in small socket welded nipple in the main steam line could result in a costly turbine shutdown. A single bucket made of the wrong material could shorten the period of optimum efficiency and require large sections of the turbine to be dismantled and returned to the factory for repair.

Modern turbines necessarily have a long manufacturing cycle, so that the accumulation and storage of many parts complicate the problem of avoiding material mixup.

On-the-spot identification of finished turbine parts is one means of insuring correct application of materials. A method for identification of critical parts prior to assembly and shipment has been devised. The object of this paper is to show how a spectroscope was modified for use as a portable instrument for sorting alloys.

Modifications for a portable spectroscope: Major problem was attachment of a counter electrode holder and sample guide to the body of the spectroscope. Closeup of attached electrode holder and sample guide, **left**, shows how modifications were made. (A) Collet-securing fixed counter electrode support rod and adjustable sample guide support rod to spectroscope. (B) Counter electrode holder. (C) Sample guide. (D) Insulating rod made of high heat-resistant glass laminate. Spectroscopic inspection, **right**, of large studs in turbine factory. (59—A-56)



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Aviation

Development of a Maintenance Program for Jet Transport Aircraft..59—A-187... By J. F. Roche, Trans World Airlines, Inc., Kansas City, Mo. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

Maintenance of jet-transport aircraft has as its ultimate objective the safe and economical operation of the aircraft in scheduled service. To this end, it is necessary that a program for inspection and overhaul be formulated in order to provide a plan whereby maximum service is obtained from every part and component.

The jet aircraft is a complex assembly of parts and systems. Many of these parts are common and familiar to the industry, others are different to the extent that they require exceptional attention. Among the latter are the Mach trim system, vortex generators, and yaw damper controls. Each of these demands its own type of special attention from the airline electrician, hydraulics or instrument specialists, or other technicians.

In developing a maintenance program for the complex aircraft it is essential that the functions of the inspection, field-maintenance, and overhaul departments be integrated. Formulating such a program is often facilitated by a co-operative effort of an airline's technical staff with the airframe and engine manufacturers.

This paper reviews a number of considerations which must be resolved in developing a practical maintenance program, outlining an approach for achieving a balanced solution to the problem.

Several typical maintenance deficiencies found in transport aircraft are presented to emphasize the need to "design for maintenance."

Overhaul Shop Planning for the P&WA Turbojets..59—A-229... By E. C. Norton, Pratt and Whitney Aircraft, East Hartford, Conn. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

The relatively sudden introduction of the turbojet engine with its peculiar overhaul shop requirements meant, in many cases, the construction of completely new facilities with the resulting opportunities for methods and planning engineers to apply the latest techniques in overhaul processes and shop layouts that were available to the industry. The aircraft engine, however, does not lend itself to automation in general owing to the relatively low overhaul production rates, the continual modifications in design, changes in overhaul requirements, and the absolute need for rigid quality control.

The nature of the turbojet engine, its overhaul requirements, and the type of overhaul facility that result are described in this paper.

A description in summary form of the Pratt and Whitney Aircraft JT3 turbojet engine is given; and the principal overhaul operations and processes involved with a brief discussion of some of the important considerations in planning an overhaul shop are also noted.

A layout of a JT3 turbojet engine overhaul shop of one-engine-per-shift capacity is presented to illustrate the size and type of facility that would embrace the author's view of good assembly techniques, parts processing, handling methods, parts flow patterns, and departmental relationships that are discussed in the paper.

Turbine Propeller Power Plant Airline Maintenance..59—A-189...By D. W. Crosby, Eastern Air Lines, Inc., Miami, Fla. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

The Lockheed Model 188A Electra airplane currently is approved for 113,000 lb gross weight at take-off and can transport 70 passengers at approximately 400 mph at 20,000 ft. Each of the four power packages contains an Allison Model 501-D13 axial-flow, gas-turbine engine and an Aeroproducts Model A6441FN-606 capable of producing 3750 equivalent shaft horsepower.

Basically, airline maintenance procedures fall under two major headings; namely, Federal Aviation Agency (FAA) regulations and the various airlines' maintenance policies.

The FAA regulations set forth the minimum requirements that experience has indicated will provide airworthy equipment for public transportation. Above and beyond these minimum standards, the airlines have developed policies and procedures which experience has proved are required to provide the safest, most dependable and economical operation practicable at the present level of air-transport development.

The Electra power plant is being maintained on a scheduled periodic service inspection-and-overhaul basis which is in phase with the craft's continuous maintenance program.

The maintenance procedures are outlined and maintenance experience noted in this paper.

Hydraulics

Vibration of Water-Turbine Draft Tubes..59—A-96...By M. Murakami, Osaka City University, Osaka, Japan. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

The vibration in the draft tube of a water turbine is most severe when the turbine is running on part load.

This is caused principally by the vortex core of whirling water in the draft tube.

The theoretical and experimental investigations of the frequency and force of periodic vibration caused by the vortex core are described, and there is clarification of the draft-tube surge caused by vibration due to the vortex core.

A New Runaway Speed Limiter for Kaplan Turbines..59—A-103...By G. H. Voaden, Mem. ASME, Allis-Chalmers Manufacturing Company, York, Pa. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Power**; available to Oct. 1, 1960).

The object of the paper is to show that the maximum runaway speed of a Kaplan turbine can be reduced, from 2.5 to 3.0 times normal, inherently common for this type, to a maximum value of less than 1.85, thus substantially reducing the cost of the generator.

This is accomplished by means of a dependable "Runaway Speed Limiter"

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Gas Turbine Power

Development of a 3500-Hp Marine Gas Turbine..59—A-199...By D. W. Knowles, Curtiss-Wright Corporation, Utica, Mich. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

In 1954 the Bureau of Ships, USN, established a requirement for a modern gas-turbine propulsion power plant incorporating the results of recent advances in the state of the turbine art.

In order to fulfill the Navy's need for a versatile propulsion engine for both ships and high-speed boats, the following design requirements were established:

1 3500 hp with specific fuel consumption of 0.59 lb per bphr burning Navy diesel fuel.

2 Good part-load fuel economy.

3 Provision for subsequent addition of an exhaust-heat exchanger without major design changes.

4 Minimum length consistent with 3.

5 Overhaul life of 5000 hr under severe naval operating conditions.

6 Capability for rapid starting and power transients.

7 Low specific weight without compromising engine life.

In addition, the engine had to be capable of ingesting salt spray, sustaining gun and depth-charge shocks, and withstanding the straining inherent in naval installations. The propulsion application established a requirement for stable operation throughout a wide power range from 200 to 3500 hp.

The mechanical design, the materials, the aerodynamic design, and the development program for the 3500-hp marine gas turbine are treated in this paper. Details are given of developmental work on the compressor, compressor turbines, engine matching, combustor, and gas generator.

Considerations for the Reduction of Noise in Ship Installations of Gas Turbines..59—A-238..By E. H. Herrmann, Mem. ASME, U. S. Naval Engineering Experiment Station, Annapolis, Md. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

One of the most serious disadvantages in the use of gas turbines in naval vessels is the noise generated. Noise is particularly detrimental to the comfort and communication of personnel. Methods used for the reduction of noise from a gas turbine differ from those used for other naval machinery primarily because of: (*a*) The frequency of the noise generated; (*b*) the unique problems arising from installation of sound-absorption materials, such as shock resistance, fire resistance, and resistance to sea-water deterioration; (*c*) the erosion effect of high-velocity air; and (*d*) the high temperatures associated with the operation of gas turbines and their exhaust systems.

General noise-reduction considerations for shipboard installation of gas turbines are discussed. Specific information relating to sound-absorption materials, duct treatments, structure-borne sound isolation, and air-borne sound insulation is graphically presented.

25,000-Kw Mene Grande Gas Turbine Installation..59—A-191...By C. M. Honaker, Assoc. Mem. ASME, Mene Grande Oil Company, Barcelona, Venezuela; and D. F. Bruce, Mem. ASME, Westinghouse Electric Corporation, Philadelphia, Pa. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

Mene Grande Oil Company's central-power system utilizing gas-turbine prime movers is described in this paper. The electrification program including a central power plant, distribution system, and replacement of engine drives represents a capital investment of over $12 million.

(*Continued on page 70*)

recently developed. The paper sets forth the basic principles involved and the confirmation of these principles by laboratory and field tests. It discusses several ways of utilizing these principles and leads to the selection of the preferred type on the basis of reliability. It then gives examples of applications of the selected type of Runaway Speed Limiter to new Kaplan units and results of the field tests available to date.

Design Control of Overcompression in Rotary-Vane Compressors..59—A-109... By E. O. Bransford, Beaman Engineering Corporation, Greensboro, N. C.; and R. A. Stein, Assoc. Mem. ASME, Battelle Memorial Institute, Columbus, Ohio. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

In its simplest terms, the design of a rotary-vane compressor of a given displacement consists of selecting a particular combination of rotor and cylinder radius, cylinder length, and number of vanes.

A study of the rotary-vane compressor has shown that the choice is not entirely arbitrary since thermodynamic and mechanical losses occurring in the compressor are intimately associated with these basic dimensions.

One of the more important of these geometrically dependent losses was found to be potentially severe overcompression during the discharge process. In this paper, an equation is developed that describes in generalized form the relation of overcompression to the dimensions of the compressor. This equation is used to evolve an energy-loss criterion for design control of this loss. An example of the application of the criterion to a refrigeration compressor is included.

Field Adjustment of Hydraulic-Turbine Governors..59—A-108... By C. L. Avery, Mem. ASME, Woodward Governor Company, Rockford, Ill. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

Governors for a-c hydroelectric generators are of the hydraulic type and are furnished with damping devices to provide stable control of the associated generating unit. In the United States and Canada hydraulic-turbine governors have been furnished chiefly with compensating dashpots to provide the required damping for stability.

This paper discusses certain aspects of the adjustment of hydraulic-turbine governors for stable operation on a-c networks and describes a series of field tests performed to determine satisfactory adjustment of units operating on a network of limited capacity.

Simplified Instrumentation and Field Checking of Hydraulic Turbine Governors..59—A-124... By B. E. Wheeler, Baldwin-Lima-Hamilton Corporation, San Francisco, Calif. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

Preventive maintenance in regard to governor equipment is one of the more important and, in most instances, one of the least understood phases of present-day power plant maintenance.

This paper will outline the converting of a standard test instrument of minimum cost and complexity to a test unit that will permit periodic field checking of governor equipment.

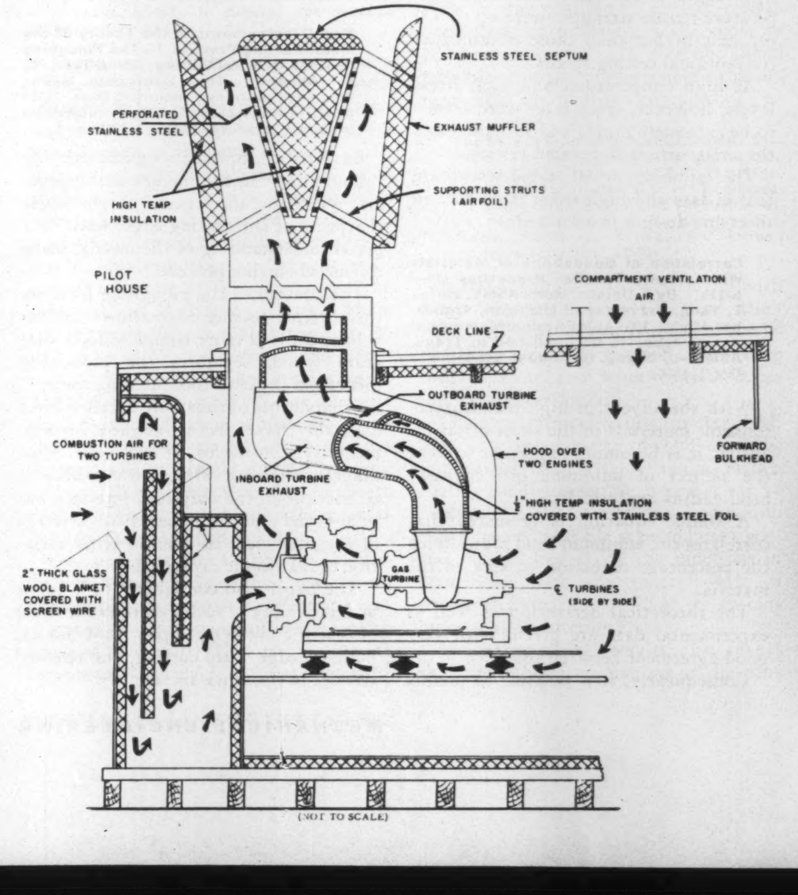
It will also discuss the ways and means of using this instrument to determine the condition of a governor unit and to pin-point areas of trouble.

Field Testing and Adjusting of Hydraulic Turbine-Generator to Improve System Regulation..59—A-149... By H. M. Stone, Assoc. Mem. ASME, Southern California Edison Company, Los Angeles, Calif. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

Some of the results and methods of extensive hydro prime-mover governor tests conducted at the Big Creek Hydro System of the author's company are presented. Each governor response was improved by making co-ordinated governor adjustments.

Frequency-response curves and dead band *X-Y* charts are included to show the improvement obtained. Frequency dead band and the governor transient response time were improved as much as 50 per cent.

A good share of the credit for the results and improvements obtained is due to the use of adequate test equipment. As described elsewhere, the Mobile Dynamics Laboratory for Studying Generating Plant Controls and Governors was designed and used for extensive preliminary tests. Later, a small compact test rig, described in this paper, was assembled and used for the routine testing and adjusting of governors.


STAINLESS STEEL SEPTUM
PERFORATED STAINLESS STEEL
EXHAUST MUFFLER
SUPPORTING STRUTS (AIRFOIL)
HIGH TEMP INSULATION
PILOT HOUSE
COMPARTMENT VENTILATION AIR
DECK LINE
OUTBOARD TURBINE EXHAUST
COMBUSTION AIR FOR TWO TURBINES
HOOD OVER TWO ENGINES
FORWARD BULKHEAD
INBOARD TURBINE EXHAUST
½" HIGH TEMP INSULATION COVERED WITH STAINLESS STEEL FOIL
2" THICK GLASS WOOL BLANKET COVERED WITH SCREEN WIRE
GAS TURBINE
℄ TURBINES (SIDE BY SIDE)
(NOT TO SCALE)

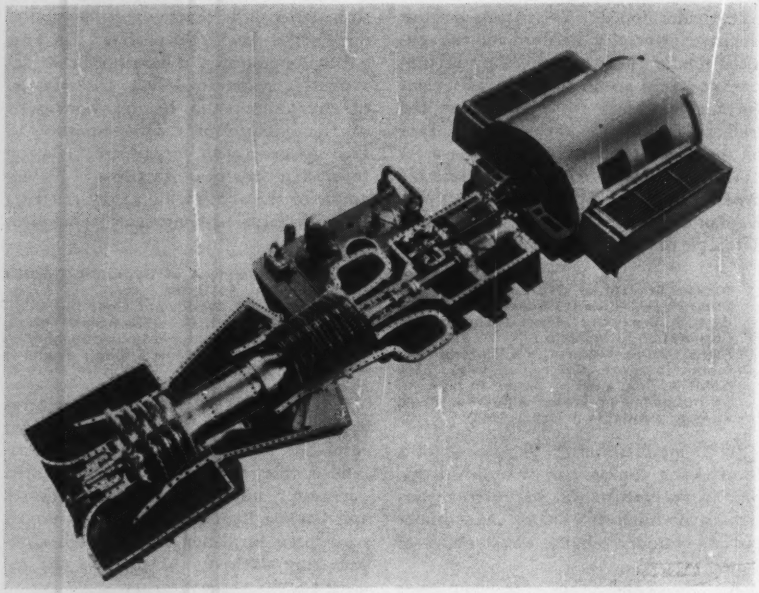
Gas-turbine-powered 40-ft LCP(P), **above**, has one serious disadvantage—noise. Typical shipboard installation of a gas-turbine, **left**, for minimum noise output. (59—A-238)

Gas Turbine Power *(continued)*

The system was designed and built to satisfy the power requirements for the exploration, production, and transportation of oil at the company's Eastern Venezuelan concessions. The system is completely isolated.

The original plant consisting of three 5000-kw turbogenerators and substation was completed in the latter part of 1955; a fourth unit was added in 1958; and a fifth was placed on the line in 1959.

The gas turbines installed at the power plant are Westinghouse Model W-81G with a rating of 5000 kw each. Each unit is a self-contained power plant and can be fully loaded from a cold start in a matter of minutes. Of particular interest in these turbines are the horizontal split single casing, two-bearing construction, absence of hp air seals and bearings in the hot-gas zones, and ready accessibility for inspection and maintenance of all parts. Major design features of gas-turbine components, turbine availability and reliability, operating costs, repair and maintenance costs, manpower requirements, and future plans are outlined.



Shop-test view of 5000-kw gas turbine, one of five in use on Mene Grande system. Note ready accessibility for inspection and maintenance of all parts. (59—A-191).

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Production Engineering

A Photoelastic Analysis of Machining Stresses..59—A-37... By E. Usui and H. Takeyama, Government Mechanical Laboratory, Tokyo, Japan. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Indus.;** available to Oct. 1, 1960).

Direct measurements of the distributions of normal and frictional stresses on a rake face under cutting conditions have been considered to be practically impossible. However, as reported in this paper, the stress distributions have been successfully obtained photoelastically by using a tool made of a photoelastic material.

According to the authors' experiment, the frictional stress on the rake face is distributed uniformly over a wide range of the tool-chip contact length, but it decreases rapidly near the point of chip.

As to the normal stress, it has a peak near the cutting edge, being rather stationary in the middle part of the contact length and decreasing gradually toward the point of chip separation.

Tensile and Short-Time Creep Properties of N-155 Alloy Sheets..59—A-27... By E. C. Burnett, The Marquardt Corporation, Van Nuys, Calif. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Indus.;** available to Oct. 1, 1960).

The special test equipment and procedures developed for the evaluation of ultrashort-time elevated-temperature mechanical properties of materials are described herein.

The tensile and high-stress creep data obtained for Haynes N-155 alloy sheet are reported.

At rapid strain rates, the high-temperature tensile strengths were up to 300 per cent higher than those obtained at conventional testing speeds.

At high temperatures and high stress levels, however, creep rates were shown to be extremely rapid, and in most cases the creep strength became critical.

The application of rapid-strain-rate tensile data and high-stress creep data in short-life designs is discussed.

Correlation of Bendability of Materials With Their Tensile Properties..59—A-110... By J. Datsko, Mem. ASME, and S. T. Yang, University of Michigan, Ann Arbor, Mich. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Indus;** available to Oct. 1, 1960).

With the advent of high-temperature-resistant materials in the sheet-metal industry, it is becoming important to treat the subject of minimum or "critical" bend radius analytically.

A simple equation is presented that correlates the minimum bend radius with the percentage reduction of area of the material.

The theoretical derivation as well as experimental data are given, with very good agreement between the two.

Consequently, it is possible to predict the minimum bend radius for a specific material, provided that the percentage reduction of area, as determined by a standard tensile test, is known.

The relationship applies equally well to metals and nonmetals.

New Developments in the Theory of the Metal-Cutting Process, 1—The Ploughing Process in Metal Cutting..59—A-243... By P. Albrecht, The Cincinnati Milling Machine Company, Cincinnati, Ohio. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

Revelation of the significance of "ploughing" in the metal-cutting process, which occurs because of the finite sharpness of the cutting edge, leads to a better understanding of the mechanics of the metal-cutting process.

The concept of the ploughing force on the extreme cutting edge allows the development of a more complete force diagram which separates the ploughing force from the chip-tool interface force.

Components of this more detailed force diagram have been verified experimentally. In terms of the new force diagram the real value of the coefficient of friction on the chip-tool interface has been found and the paradox of variation of the coefficient of friction with variation of rake angle explained.

The paper also contributes to a better understanding of such events as the effect of cutting velocity upon tool forces, built-up edge, chip curling, and residual stresses in the work surface.

Machine Design

Determination of Cutter Trajectories for Contoured Turbine Buckets..59—A-111... By R. G. DeBiase, General Electric Company, Schenectady, N. Y. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Indus.**; available to Oct. 1, 1960).

The advent of numerically controlled machine-tool systems introduces the serious problem of suitably employing them for part fabrication.

To numerically contour the complex surface of a large turbine bucket with this type of machining system, it is necessary to determine the geometrical constraints on the motion of the cutter, which will sweep out the desired part surface as an envelope of the cutter surface.

A definition of the turbine-bucket surface is given in terms of unequally spaced cross sections along the length of the part, and an interpolating procedure is employed to define the entire surface with properly faired transitions between the specified cross sections.

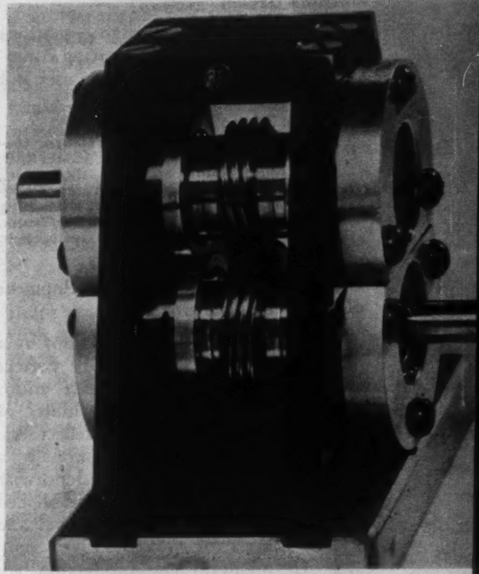
The procedures outlined in this paper have been used to program an IBM 704 computer for the preparation of digital control tapes, which instruct the motions of the machining system.

The Twinworm Drive—A Self-Locking Worm-Gear Transmission of High Efficiency..59—A-75... By B. Popper, Israel Ministry of Defense, Tel Aviv, Israel; and D. W. Pessen, Assoc. Mem. ASME, Israel Institute of Technology, Haifa, Israel. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Indus.**; available to Oct. 1, 1960).

Up to the present, it has always been accepted as a proved and well-established fact that worm gears or screw threads that are self-locking are bound to have an efficiency of less than 50 per cent. An entirely different type of worm transmission has been developed which is self-locking, yet has a theoretical efficiency that can almost reach 100 per cent. Efficiencies of 90 per cent and above can easily be obtained in practice, and have, in fact, been obtained in models built by the authors. In addition, this new transmission exhibits a number of other unique and useful properties.

The paper describes the transmission and develops the theory upon which its

(Continued on page 72)



Demonstration model of Twinworm drive with second-order self-locking. Experimental tests showed this drive to have an efficiency of 87 per cent. (59—A-75)

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Comparisons Between the Shearing Properties of Alpha-Brass as Derived From the Cutting Process and From Static and Impact Torsion Tests..59—A-38... By S. S. Chang, Mechanical Engineering Research Laboratory, Glasgow, Scotland; and W. B. Heginbotham, University of Nottingham, England. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Indus.**; available to Oct. 1, 1960).

In the work presented here direct comparisons were made between the results obtained by analyzing the cutting process and the results of both static and impact torsion tests on the same material. The material used was alpha-brass (70 to 30 per cent Cu-Zn). Choice rested on this material because it appeared to exhibit a very large internal frictional coefficient if results obtained from an "orthogonal" cutting test were analyzed in terms of the now familiar Merchant analysis. These cutting tests indicated that the sum $2\phi + \tau - \alpha = 67$ deg ± 5 per cent if the correct cutting conditions were chosen. The difference between 67 deg and the ideal figure of 90 deg, which should be the case if the material exhibits no Bridgman effect, should therefore be easy to find. It is shown that this difference could not be accounted for by the internal frictional coefficient effect.

Due to the failure to explain the difference, efforts were shifted toward an evaluation of the possible effects of rate of strain on the stress-strain curve for the material. Toward this end a special impact-torsion machine was designed capable of impressing strain rates of 1000 per second abruptly to a tubular specimen.

Photomicrographs covering the range of conditions tested were produced by an abrupt stopping technique, and from these it was possible to explain certain variations, particularly in the constant $2\phi + \tau - \alpha = C$. It was not found possible to make any estimate of strain rates from the photomicrographs.

The Role of Friction in Metal Cutting..59—A-132... By S. Kobayashi, Doshisha University, Kyoto, Japan; and E. G. Thomsen, Mem. ASME, University of California, Berkeley, Calif. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Indus.**; available to Oct. 1, 1960).

Metal-cutting studies were made with free-cutting steel SAE 1112 and alloy steel SAE 4135 in the as-received condition with artifically controlled tool-chip contact areas and flank contact areas (artificial wear lands).

The experimental results for steel SAE 1112 at a speed range of 0.083 to 1010 fpm reveal that friction under metal-cutting conditions on the rake face can be explained satisfactorily by a junction model, with possible superimposed general plastic flow above the junctions in accordance with the general rules of plastic deformation (von Mises instantaneous yield criterion).

The experimental results also reveal that the friction mechanism at the controlled flank-wear contact area is essentially the same as that occurring at the tool face.

The difference in behavior of the two steels was attributed to the role that manganese sulfide appears to play in free-cutting steels.

A Critical Comparison of Metal-Cutting Theories With New Experimental Data..59—A-131... By S. Kobayashi, Doshisha University, Kyoto, Japan; R. P. Herzog, Aerojet-General Corporation, Azusa, Calif.; and D. M. Eggleston and E. G. Thomsen, Mem. ASME, University of California, Berkeley, Calif. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Indus.**; available to Oct. 1, 1960).

The following alloys were investigated in orthogonal metal-cutting tests at varying cutting speeds, rake angles, and feeds: Steel SAE 1112 annealed and as-received; steel SAE 1020 as-received; steel SAE 4135, annealed, as-received, and Rockwell hardnesses 27 and 35–37; aluminum alloy 2024-T4; aluminum alloy 6061 in the 0 and T6 conditions; alpha brass.

The new data obtained in the present investigation under wide variation of test conditions (speed for SAE 1112 annealed and as-received was varied from 0.083–1010 fpm) confirmed earlier observations that the shearing stresses are independent of the test conditions investigated. These observations were supported by theoretical considerations.

Machine Design *(continued)*

operation is based. Design equations are derived for different operating conditions, and a number of possible uses and applications are discussed.

Helixform Bevel and Hypoid Gears..59—A-90...By G. M. Spear, Mem. ASME, C. B. King, Mem. ASME, and M. L. Baxter, Jr., Mem. ASME, The Gleason Works, Rochester, N. Y. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Engng. for Indus.**; available to Oct. 1, 1960).

Objectives sought in the development of the Helixform process were:

1 To produce gears and pinions by a method which gives basically correct tooth bearings with conjugate tooth action within the practical limits of manufacturing tolerances and deflections.

2 To produce gears and pinions by a process which maintains the depthwise taper of the teeth which is the established standard of design for spiral bevel and hypoid gears.

3 To maintain the production advantages of the nongenerated-type gear.

4 In so far as heat-treatment distortions permit, to eliminate empirical methods of obtaining desired tooth bearings.

5 To achieve mathematical simplicity in both theory and calculation.

The Helixform process is a recent development in the art of gear cutting. Gears made by this method are classified as nongenerated, which means that the workpiece remains at rest while the teeth are being cut.

Cutting the gear without generation is a process especially adapted to high production and accurate machining and is the method used to manufacture most automotive spiral bevel and hypoid gears.

Pinions which match nongenerated gears are of course produced with generating motion, that is, the tools cutting the teeth of the pinion are mounted on a machine element which, while the teeth are being cut, turns in concord with the turning of the pinion on its axis.

Gear-Position Error Control..59—A-21...By G. W. Michalec, Mem. ASME, General Precision Laboratory, Inc., Pleasantville, N. Y. 1959 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1960).

Recent requirements for increased precision of gears have revealed shortcomings in currently used gear terminology, specification, and inspection. The accuracies now sought in some special cases place significance upon considerations which previously could be neglected.

A particularly important item is the angular position error of gears, which in this paper is included within the broader and shorter designation, "Position Error."

A detailed definition of position error is included in order to present a complete understanding of this over-all error term and avoid terminology difficulties due to the lack of standardized nomenclature.

The limitation of using total composite error as a criterion of gear quality is primarily due to its inability to detect accumulation of position error. This is becoming more widely understood and there is a new emphasis on position error (sometimes called index error) specification and check.

This paper deals with the natures of position error and total composite error, and their relative limitations and applications. Information is given on equating position errors and total composite errors and their specification for high-precision gears.

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Fluid Meters

The Twin Throat Venturi: A New Fluid-Flow Measuring Device..59—A-154...By A. A. Kalinske, Infilco Incorporated, Tucson, Ariz. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

The venturi tube as it was originally developed by Clemens Herschel some 70 years ago has been the standard fluid-flow measuring device wherever an over-all low head loss was desired. The Twin Throat Venturi is a more recent development by a German meter manufacturer and is now available in various standard sizes in the United States.

The purpose of this paper is to describe the design of the Twin Throat Venturi and the theory on which it is based, and to present information relating to its discharge coefficient and loss of head.

During the past decade there have been developments in connection with modifying the standard venturi in order to decrease further the required laying length, without sacrificing the relative low head loss as compared to orifice-type metering devices. By utilizing the effect of changes in velocity, both in direction and in magnitude, the so-called Dall tube was developed in England and the Twin Throat Venturi in Germany.

Comparison of standard long-form venturi type with Twin Throat Venturi (59—A-154)

Coefficients of Discharge of a Quadrant-Type Concentric Orifice Meter, With Flange, Radius, and Corner Taps..59—A-106...By H. Lopez, C. Duhne, N. Valverde, and S. Mireles, Instituto Tecnológico de Monterrey and Instituo de Investigaciones Industriales, Monterrey, N. L., Mexico; and L. P. Emerson, The Foxboro Company, Foxboro, Mass. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

Coefficients of discharge were obtained for quadrant-type orifices in order to check their constancy over a wide range of Reynolds numbers, as well as their reproducibility.

The experiments were conducted on two different meters, with two sets of six orifices, and by two different men.

The two meters were 1-in. standard pipe size. Both had 4 upstream and 4 downstream taps (corner, radius, and flange taps).

The six orifice plates were of β ratio of 0.20, 0.40, 0.50, 0.60, 0.65 and 0.70.

The coefficients over a range of tube Reynolds numbers from 1000 to 90,000 showed negligible deviation, within the experimental errors.

The reproducibility was excellent; the highest value of the standard deviation found was 1.5 per cent.

Metals Engineering

Roll-Force and Torque Coefficients for Hot-Strip Steel Mill..59—A-153... By B. N. Garudachar, Marquette University, Milwaukee, Wis.; and H. A. Peterson, Mem. ASME, University of Wisconsin, Madison, Wis. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

With the ever-increasing demand on the semifinished products such as rods, railroad rails, axles, sheets, strips, tubes, and so on, the steel industry has grown enormously in stature during the past 30 years. Since the efficiency of production is dependent upon the raw materials being within the prescribed tolerance limits, the consumer industries, notably the tin-plate and sheet-metal industries, which employ mass-production techniques, have set down standards on the quality of the raw materials. These standards, in turn, have forced the manufacturers of such rolled products to take appropriate corrective steps. The problem of keeping the gage of the rolled products within specified tolerances is further complicated by the speed with which the strip can be economically rolled. Despite the wide tolerance limits, it has been reported that in some cases nearly half of the rolled product is close to or just outside these limits.

One of the major problems in the rolling industry, therefore, is to regulate as closely as possible the gage of the output product within the tolerance limits economically. The speeds at which economic production is possible are so great that manual control is very nearly impossible. The need for automatic gage control is both obvious and urgent.

An analytical investigation of the performance of the system comprised of the rolling mill and its control equipment is essential before the actual design and construction of the control apparatus. The analytical investigation thus includes the mathematical formulation of the performance characteristics of all elements which make up the system and the subsequent analysis of these equations of performance. In the process of the formulation of the mathematical model for subsequent analysis, it is necessary that numerical values of the various parameters entering the equations be determined. It is the purpose of this paper to provide numerical data pertaining to the rolling mill which are not available at this time, in order to facilitate further analysis. Thus the characteristics of roll-mill motors are excluded from this discussion.

A brief review of the principles of gage control in sheet-and-strip-rolling mills is included.

Cycle-Dependent Stress Relaxation of A-286 Alloy..59—A-116... By A. S. Ross, Boeing Airplane Company, Renton, Wash.; and JoDean Morrow, University of Illinois, Urbana, Ill. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

When an axial fatigue specimen is subjected to repeated strain cycling about a fixed mean strain value, the mean stress decreases with the number of strain cycles.

To explore this type of material behavior, tubular fatigue specimens of A-286 alloy have been axially tested under conditions of controlled strain, and the cycle-dependent relaxation of mean stress measured.

Fatigue data for five initial mean stresses are also reported.

It was found that, in the case of A-286 alloy, most of the relaxation occurred early in the fatigue life, especially during the first ten cycles.

Steady-State Creep of a Thick-Walled Cylinder Under Combined Axial Load and Internal Pressure..59—A-57... By Iain Finnie, Assoc. Mem. ASME, Shell Development Company, Emeryville, Calif. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

Equations are developed for prediction of steady-state creep stresses and strain rates in a thick-walled tube under combined internal pressure and axial load.

An analytical solution of the equations, in closed form, is not possible, but numerical solutions to the equations are tabulated for various values of the variables.

For values of the variables, other than those tabulated, interpolation is usually adequate.

If this is not the case, a trial method of calculation is presented which uses the tabulated solutions as a starting point.

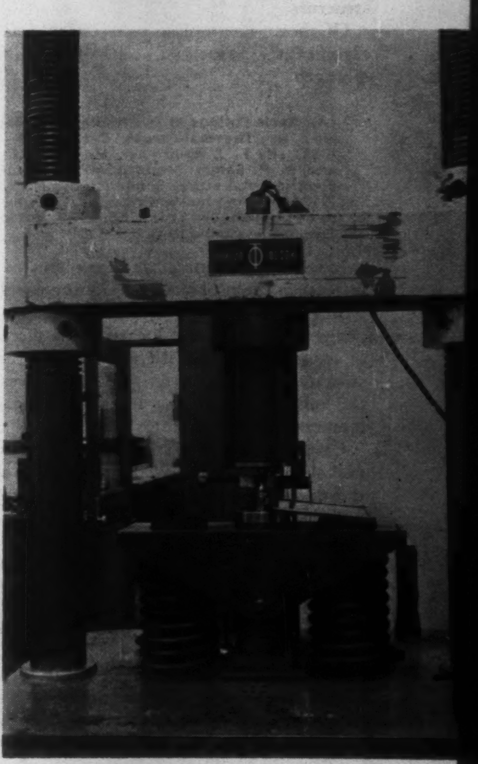
Simple approximate solutions, which apply for the cases in which the additional axial load is small or large relative to the axial load due to internal pressure, are also given.

The Stability of Metals Under Cyclic Plastic Strain..59—A-100... By L. F. Coffin, Jr., Mem. ASME, General Electric Company, Schenectady, N. Y. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to Oct. 1, 1960).

A striking demonstration of the instability of ductile metals when subjected to cyclic plastic strain was found in the case of commercially pure aluminum subjected to a push-pull type of test. Here cyclic strains were measured by means of the change in diameter of an hourglass-shaped test specimen. In the process of testing, a lightly loaded dial gage rested against the minimum-diameter position of the specimen. It was observed that after a number of cycles of strain the prismatic head of the dial gage had made an indentation into the material. At first it was felt that this indentation was due to a scraping effect of the contacting edge against the material. When the contacting edge was rounded off to a radius of $^{1}/_{16}$ in. the indentation still occurred. It again appeared even after the contacting edge had been coated with several layers of transparent plastic tape. It became evident that the effect was related to the combined behavior of the low steady pressure applied by the dial gage and the cyclic plastic strain occurring at this section. With each cycle of plastic strain, a small component of monotonic strain was produced by the action of the steady stress, such that after many cycles a visible deformation was produced.

The deformation phenomenon produced by mean stresses accompanying cyclic plastic strain will be referred to here as cyclic-strain-induced creep.

It is evident that the effect can become an important design problem in materials. This is particularly so when dealing with systems subjected to severe



Test apparatus for cyclic tension tests on metals. Hourglass-shaped test specimen is subjected to longitudinal push-pull load. (59—A-100) cyclic thermal stresses, where continual growth or deformation may become more important than fatigue or fracture. The problem must be carefully defined from the point of view both of material behavior and design. It is the purpose of this present paper to examine the behavior of real material subjected to cyclic plastic strain in combination with mean stresses.

Burst Strengths and Deformations of Welded Composite Turbine Wheels as Related to Weld Quality and Plasticity Calculations..59—A-28... By A. G. Holms and A. J. Repko, Lewis Research Center, National Aeronautics and Space Administration, Cleveland, Ohio. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.;** available to Oct. 1, 1960).

Experimental justification is presented for extending an existing rotating-disk deformation theory finite-difference plastic-flow calculation method to predicting the deformation and fracture of welded composite aircraft gas-turbine wheels.

Calculated deformations generally equaled but sometimes exceeded measured deformations.

Fractures could be predicted for wheels containing no significant defects.

Defects observed in fracture surfaces were incomplete penetration, incomplete fusion, porosity, and coarse columnar structure.

Of these, incomplete penetration was significantly associated with losses in strength.

Low-Cycle Fatigue of Two Nickel-Base Alloys by Thermal-Stress Cycling..59—A-58... By F. J. Mehringer, Mem. ASME, and R. P. Felgar, Mem. ASME, General Electric Laboratory, Schenectady, N. Y. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Basic Engng.;** available to Oct. 1, 1960).

In recent years there has been increased interest in the problem of designing parts which are subjected to temperatures that change with time and location in a piece of equipment. The thermal fatigue resistance of a new material now receives the same attention as its static high-temperature properties.

Cast DCM and cast Udimet 500, two nickel-base alloys, were tested in a thermal-stress-cycling device of the Coffin type.

The strains induced by the thermal stresses were analyzed in several ways in an attempt to relate the plastic strains to cyclic life.

The plastic strains were too small to permit calculating them with sufficient accuracy to correlate with cyclic life.

It was found, however, that stress range did correlate reasonably well with the number of cycles to failure.

Applied Mechanics

Plane-Stress Unloading Waves Emanating From a Suddenly Punched Hole in a Stretched Elastic Plate..59—A-46... By Julius Miklowitz, Mem. ASME, California Institute of Technology, Pasadena, Calif. 1959 ASME Annual Meeting paper (in type; to be published in **Trans. ASME—J. Appl. Mech.;** available to Oct. 1, 1960).

The present paper points out that Kromm's plane-stress solution, for compressional waves in an infinite elastic plate subjected to radial pressure in a circular hole at its center, has application to still another problem of interest.

This is the problem of a stretched elastic plate in which a circular hole is suddenly punched. The plane-stress solution for the tensile circumferential stresses, generated by the unloading mechanism in punching, is given here. This solution is derived independently of Kromm's work in which a rather special Laplace-transform technique was used.

The derivation given here also makes use of the Laplace transform but in a more direct manner, employing the inversion integral and a contour integration.

It is also shown that the present inversion technique offers important simplifying features over that used by Selberg in the closely related plane-strain problem. The numerical results presented are of interest in fragmentation studies.

It is shown that the dynamic circumferential stress field in the vicinity of the punched hole is quite severe, which would be important to the creation and propagation of radial cracks.

ASME TRANSACTIONS

The December, 1959, issues of the Transactions of the ASME—*Journal of Applied Mechanics* and *Journal of Basic Engineering* (available at $1.50 per copy to ASME Members; $3 to nonmembers)—contain the following:

Journal of APPLIED MECHANICS

Volume 81 • Series E • Number 4

TECHNICAL PAPERS

477 Boundary-Layer Solution for a Flow in a Diverging Passage Having a Swirl Component, M. A. Sinbel. (59—APMW-14)

485 Slow Rotatory Motion of a Circular Disk About One of Its Diameters in a Viscous Fluid, R. P. Kanwal. (59—APMW-6)

488 Thermal Stresses Owing to a Hot Spot in a Rectangular Strip, C. W. Nelson. (59—A-8)

491 Impact and Moving Loads on a Slightly Curved Elastic Half Space, A. C. Eringen and J. C. Samuels. (59—A-2)

499 Stability of Forced Oscillations With Nonlinear Second-Order Terms, Chi-Neng Shen. (59—A-19)

503 On Inertia Effects in a Transient Thermoelastic Problem, Eli Sternberg and J. G. Chakravorty. (59—APM-9)

510 Coupled Torsional and Longitudinal Vibrations of a Thin Bar, R. C. Di Prima. (59—A-18)

513 Production of Rotation in a Confined Liquid Through Translational Motion of the Boundaries, R. R. Berlot. (59—A-15)

517 Nonlinear Creep Deformations of Columns of Rectangular Cross Section, H. H. Bleich and O. W. Dillon, Jr. (59—A-1)

526 Forced Vibrations of a Circular Plate, Herbert Reismann. (59—A-9)

528 On the Propagation of Shock Waves in a Nonhomogeneous Elastic Medium, Eli Sternberg and J. G. Chakravorty. (59—APMW-17)

537 The Frequency of Flexural Vibration of Rectangular Orthotropic Plates With Clamped or Supported Edges, R. F. S. Hearmon. (59—APM-8)

541 Axially Symmetric Extensional Vibrations of a Circular Disk With a Concentric Hole, O. G. Gustafsson and T. R. Kane. (59—A-32)

546 Analysis of a Nonlinear Mechanical System With Three Degrees of Freedom, S. A. Hovanessian. (59—APM-29)

549 Stresses in an Ellipsoidal Rotor in a Centrifugal Force Field, M. A. Goldberg and Michael Sadowsky. (59—A-4)

553 Carrying Capacity of Elastic-Plastic Shells With Various End Conditions, Burton Paul. (59—APM-16)

561 Extensional Vibrations of Elastic Plates, R. D. Mindlin and M. A. Medick. (59—APM-4)

570 Triaxial Tension at the Head of a Rapidly Running Crack in a Plate, J. M. Frankland. (59—APM-11)

573 Viscous Flow Through Tubes of Multiply Connected Cross Sections, F. A. Gaydon and H. Nuttall. (59—APM-28)

577 On the Accuracy of Some Shell Solutions, G. D. Galletly and J. R. M. Radok. (59—APM-30)

584 The Drag on Spheres and Cylinders in a Stream of Dust-Laden Air, Thomas Gillespie and A. W. Gunter. (59—APM-14)

587 Elastic Flexible Cable in Plane Motion Under Tension, Wen-Hsiung Li. (59—A-6)

594 Incremental Stress-Strain Law Applied to Work-Hardening Plastic Materials, Chintsun Hwang. (59—APM-15)

599 On the Plastic Flow of Coulomb Solids Beyond Original Failure, A. W. Jenike and R. T. Shield. (59—A-7)

603 The Free Vibrations of Grillages, J. P. Ellington and H. McCallion. (59—APMW-12)

608 Piping Flexibility Analysis by Stiffness Matrix, L. H. Chen. (59—APM-24)

613 A Photoelastic Approach to Transient Stress Problems Employing Low-Modulus Materials, J. W. Dally, W. F. Riley, and A. J. Durelli. (59—A-10)

621 Rupture Characteristics of Safety Diaphragms, N. A. Weil. (59—APMW-3)

625 Bending of Isosceles Right Triangular Plates, H. J. Fletcher. (59—APMW-19)

629 Developments in the Application of the Grid Method to Dynamic Problems, A. J. Durelli, J. W. Dally, and W. F. Riley. (59—APMW-1)

635 The Solution of Elastic Stability Problems With the Electric Analog Computer, J. H. Shields and R. H. MacNeal. (59—APMW-20)

643 Symmetric Vortex Separation on Circular Cylinders and Cones, A. E. Bryson. (59—APMW-13)

649 Thermoelastic Problem for a Transversely Isotropic Hollow Sphere Embedded in an Elastic Medium, J. Nowinski. (59—APM-27)

651 Transient Analysis of Stress-Wave Penetration in Plates, Norman Davids. (59—A-16)

661 Transverse Flexure of a Semi-Infinite Thin Plate Containing an Infinite Row of Circular Holes, O. Tamate. (59—APMW-15)

666 Fundamental Frequency of a Thin, Flat Circular Plate Simply Supported Along a Circle of Abritrary Radius, R. Y. Bodine. (59—APMW-10)

Journal of
BASIC ENGINEERING

Vol. 81 • Series D • No. 4

433 Applications of Computer and Model Studies to Problems Involving Hydraulic Transients, by I. W. McCaig and F. H. Jonker. (58—A-101)

446 Large Water-Level Displacements in the Simple Surge Tank, by A. W. Marris. (58—A-29)

455 Experience in the Use of the Gibson Method of Water Measurement for Efficiency Tests of Hydraulic Turbines, by N. R. Gibson. (58—A-78)

488 Free Discharge Through a Turbine Distributor, Case, and Draft Tube, by R. A. Sutherland. (58—A-76)

493 Symposium on Welded Spiral Cases From the Manufacturer's Viewpoint. (58—A-60)

505 Dériaz Type Reversible Pump-Turbine Installation at Sir Adam Beck-Niagara Forebay Pumped Storage Project, by A. E. Aeberli. (58—A-77)

521 Reversible Pump-Turbines for Sir Adam Beck-Niagara Pumping-Generator Station, by P. Dériaz and J. G. Warnock. (58—A-108)

534 Some Hydraulic Features of Puntledge Generating Plant, by A. W. Lash and R. E. Passmore. (58—A-100)

543 Application of Boundary-Layer Theory in Turbomachinery, by H. Schlichting.

552 Radial Equilibrium in Supersonic Compressors, by A. G. Hammitt and S. M. Bogdanoff. (58—A-110)

559 Resume of the Supersonic-Compressor Research at NACA Lewis Laboratory, by W. W. Wilcox, E. R. Tysl, and M. J. Hartmann. (58—A-177)

569 Application and Analysis of a Computer Control System, by Irving Lefkowitz and D. P. Eckman. (58—A-281)

578 The Response of Pneumatic Transmission Lines to Step Inputs, by C. B. Schuder and R. C. Binder. (58—A-136)

585 A General Approach to the Practical Solution of Creep Problems, by A. Mendelson, M. H. Hirschberg, and S. S. Manson. (58—A-98)

599 Multiaxial Creep Studies on Inconel at 1500 F, by C. R. Kennedy, W. O. Harms, and D. A. Douglas. (58—A-193)

610 Creep-Rupture Strength of Austenitic Cr-Ni-Mo Steels in Sheet and Bar Form, by G. V. Smith, F. Garofalo, R. W. Whitmore, and R. R. Burt. (58—A-102)

617 Correlation of High Temperature Creep and Rupture Data, by Hans Conrad. (58—A-96)

629 Comparison of Parameter Methods for Extrapolating High-Temperature Data, by R. M. Goldhoff. (58—A-121)

645 Tests on Deflection of Flat Oval Bourdon Tubes, by G. Kardos. (58—A-67)

651 Bending and Stretching of Corrugated Diaphragms, by R. F. Dressler. (58—A-62)

660 Electromagnetic Flowmeter Primary Elements, by V. P. Head. (58—A-126)

669 The Distribution of Contact Pressures in the Rolling of Metals, by C. W. MacGregor and R. B. Palme. (58—A-260)

681 The Effects of Friction in the Rolling of Metals, by M. D. Stone.

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59—A-103
59—A-106
59—A-108
59—A-109
59—A-110
59—A-111
59—A-116
59—A-124
59—A-131
59—A-132
59—A-149
59—A-153
59—A-154
59—A-187
59—A-189
59—A-191
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59—A-238
59—A-239
59—A-243
59—A-304

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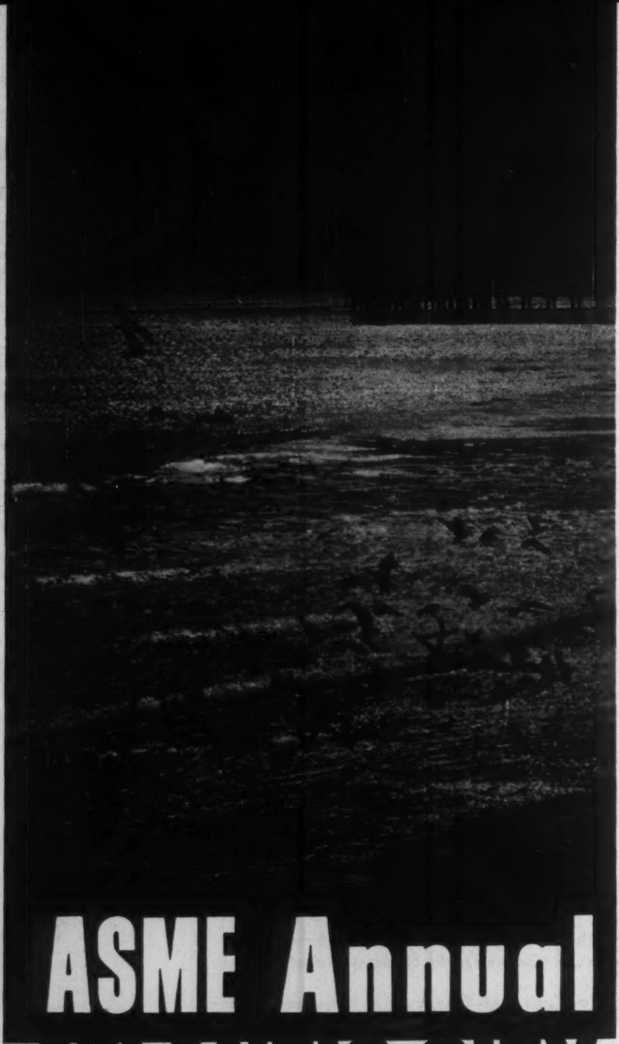

1959 ASME Annual Meeting

ATLANTIC CITY

"*I must go down to the sea again, to the lonely sea and the sky . . .*" But unlike the line from John Masefield's classic poem, the Chalfonte-Haddon Hall, which stands on the ocean front at Atlantic City, N. J., was bursting with activity as more than 4000 engineers flocked to this seashore resort to attend the 80th Annual Meeting of The American Society of Mechanical Engineers. The dates: November 29–December 4, 1959.

Theme of this Annual Meeting was "Engineering—Pathway to a Better Tomorrow." And as Outgoing President Warren, toastmaster of the Annual Banquet, so aptly stated . . . "this theme emphasizes the importance of looking ahead and contributing the benefits of our knowledge and progress to enrich the world in which we live. To do so requires some knowledge on our part of the relation of the physical sciences and the natural sciences to the social sciences.

"Engineers," he said, "have played a major part in shaping our contemporary world. They cannot, and should not shirk the ensuing social responsibilities."

Speaking in a similar vein, Incoming ASME President Walker L. Cisler, as Roy V. Wright Lecturer at the Members and Students Luncheon, urged engineers "who speak the same language all over the world" to exert further efforts to reduce tensions.

Said he: "Engineers are trained to apply technology to solve the basic causes of human want and can aid the millions who keep themselves alive through work that is tragically unproductive by our standards."

Engineering wise at the meeting, the pathway to a better tomorrow was paved with the 350 technical papers that were presented at 107 sessions. These papers were prepared by 553 authors.

The week's activities also included numerous luncheons and dinners at which 13 honors and awards were presented; inspection trips; social events; and activities for the 377 women in attendance.

In the pages which follow, we present the high lights of the 1959 ASME Annual Meeting.

ENGINEERING-PATHWAY TO A BETTER TOMORROW

Future ASME Organizational Structure?

The preliminary report of the special Technical Interest Committee of the Board on Technology was submitted for open discussion at a Sunday evening meeting of the Joint Council, Boards, and Committees. The report was the result of a study of the organizational structure of the Society in relation to fostering the technical interests at the Section level, made by Ronald B. Smith, Mead Bradner, D. H. Cornell, R. G. Folsom, and E. W. Jacobson.

The report proposed the establishment of three departments, tentatively following the groupings of the new quarterly Journals which constitute the ASME *Transactions*. Applied Mechanics and Heat Transfer would be added to the Basic Engineering journal grouping to form the Basic Engineering Department. The Industry Department and Power Department would follow the groupings of Professional Divisions and Research Committees recognized by each of those Journals.

The purpose of the Departments would be to replace the Professional Divisions Executive and Planning Committees and to provide a more effective medium for decentralization. This would free the Board on Technology as well as the Meetings and Publications Committees for their primary function of assessing the way in which the Society reflects the technical interests of the mechanical engineer. The board in particular has been burdened with much administrative detail that has obscured its primary purpose.

Ronald Smith, chairman of the committee, stated that the plan attempted to provide the "greatest degree of democracy short of chaos" in a Society that is largely operated by volunteers. It was particularly concerned with fostering the technical needs of the individual member in his Section—the "grass roots" of the Society.

Although ASME has doubled in membership since the end of World War II, and the field of mechanical engineering has broadened immeasurably in scope, there has been no decentralization of the "authority" of the Society. The basic organization above the Division structure remains essentially as it was originally set up.

The freeing of the Board and Committees of much of their administrative detail would permit more consideration of over-all policy, particularly in relation to Section-Division liaison. The essential point was characterized as the communication between 92 Sections and 24 Divisions. This would be simplified greatly on the Division side of the problem by the three-Department grouping.

The Section side of the organizational picture was purposely omitted from the report.

Each Department in addition to an Executive Committee would have a Program Committee and an Editorial Committee. In the case of the Basic Engineering Department three editorial committees were proposed, representing the three Journals that would fall in that grouping.

The Editorial Committee portion of the plan evoked more discussion than any other provision since the functions of the Editorial Committees have not yet been clearly delineated, and the relationship of the Division Papers Review Committees and the Publications Committee is not as direct as that of Division Conference Committees and the Meetings Committee. The Division Papers Review Committee is concerned principally with the technical quality and appropriateness of papers, whereas the Publications Committee is concerned with publication recommendations on individual papers only when the Editor's decision has been questioned and requires arbitration. The Technical Interest Committee is aware of this and will consider it further in preparing the final report which the Board on Technology has requested be submitted to it in 1960.

Other than the publications question there was little basic criticism of the plan. The committee was congratulated on the results that have come from its work. Incoming President Walker L. Cisler commented that the committee was certainly "going along the right road" and had "approached the problem in the right way."

Arthur W. Weber, past-vice-president of Region III, suggested that perhaps the entire Society Division structure needed an overhaul, since he had never heard of Divisions being dropped or combined. R. G. Folsom stated that any reorganization in a volunteer-operated Society needs the wholehearted support of the members if it is to work properly. Sweeping reorganizations cannot be undertaken with the facility that accompanies them in industry.

The committee indicated that the number of Departments did not have to be three and that others could be added as required. Obviously, however, if they become too numerous and begin to approach the Divisions in number or scope, they defeat their purpose. Three was selected as a workable beginning number.

Paralleling the Journal groupings in the Department structure was questioned, but recommends itself for quick recognition by the membership in an already complicated organizational picture. The cover of each of the Journals provides a convenient reference list of the Divisions and Research Committees included in that grouping.

The relationship of the plan to the program of meetings and conferences was discussed. Outgoing President Glenn B. Warren stated that the Council has recognized that the overwhelming prestige of the Annual Meeting is the key to much of the problem. The Division Conference is beginning to have the full stature that was intended to take some of the burden off the Annual Meeting.

Meetings Committee Chairman W. B. Wilkins had already emphasized that the Meetings Committee would welcome the extra personnel and relief from detail that would be provided by the plan. The Meetings Committee could profitably use its time to concentrate its attention on the over-all meeting and conference picture.

The effect of the plan on the Division structure was questioned, and it was pointed out that there was little change. The Departments would be more concerned with interdivisional relations while Division Conference responsibility would remain with the Division. General meeting responsibilities would shift to the Department.

Although no complementing structure was established for the Sections, there was some speculation on the form this should take and a discussion of some of the problems which confront a Section.

Technical Program High Lights

At the 1959 Annual Meeting in Atlantic City, technical sessions drew heavy attendance. Isolation promotes concentration, and it is characteristic of meetings held at the famed resort city that sessions are likely to be filled. There were 107 technical sessions at which 350 papers were presented. All but two of the Society's divisions offered papers.

The divisions contributed most—but not all—of the technical papers. The Society's research committees were also on hand, with papers and progress reports. Through the past year, our research committees have attracted some $302,000, contributed by industry, trade associations, and government agencies to underwrite research projects. Net cost to the Society for administering the research program came to 13.7¢ per member. During the year, three operating committees completed their projects, and four new projects were undertaken.

This year, for the first time at an Annual Meeting, the technical papers were available at every session, so that everybody had before him a copy of the paper under discussion. When the session had finished, one either returned the papers, or purchased them—at the members' price. All sales of papers at ASME meetings and conferences are on a basis of members' price.

There is a new grouping of Society publications. A year ago, the primary publication, "Transactions of the ASME," commenced publication as a series of five quarterlies—*Journal of Basic Engineering*, *Journal of Engineering for Industry*, *Journal of Engineering for Power*, *Journal of Applied Mechanics*, and *Journal of Heat Transfer*. This redesigning of our publications has resulted in greater convenience for our members, as evidenced by a strong upsurge in subscriptions to the several journals. Subscriptions now are approaching 22,000 for the five journals, a substantial increase in the circulation of ASME's technical literature.

A list of the Meeting's technical papers —authors, titles, and ASME numbers— appears in this issue, pp. 114–117. In addition, all papers which are not scheduled for publication in Mechanical Engineering will be abstracted in the magazine's "ASME Technical Digest," some in this issue, others in succeeding issues.

The following report points up the trends and activities in many of the divisions and research committees, highlighting their contributions to the Annual Meeting.

Basic Engineering

Applied Mechanics. A large number of papers in elasticity testified to the continued high degree of interest in this problem. They carried this field of interest forward and included such effects as dynamic loading, viscoelastic behavior, and strain hardening. They extended the areas of inquiry to wider classes of materials. In particular, the baffling behavior of granular materials is being studied with increasing interest.

Five papers dealt with problems in dynamics and kinematics, and eight addressed themselves to various problems involving mechanical vibrations. Problems ranged from the highly theoretical to definite design applications.

Over the last ten to twelve years, the number of Applied Mechanics papers in the fields of fluid mechanics, heat transfer, and thermodynamics shows a tendency downward. This includes subjects such as boundary layers, theory of lubrication, theoretical fluid mechanics, and free convection. It is realized that other divisions of the Society have become interested in them to a point where analytic and theoretical contributions, as distinct from specific applications, have become included. Consequently, a decline in the number of papers of this type in the Applied Mechanics Division does not signify a decline in interest. It is a reflection of the increased interest in these fields in other divisions.

Heat Transfer. The papers this year evidenced interest in the so-called reentry problem. This might better be called the entry problem, since it may well involve entry into planetary atmospheres other than that of the earth. For protection of vehicles exposed to such entry heating, unusual cooling schemes, such as mass-transfer cooling and film cooling, are of importance. They were discussed at Atlantic City. A somewhat novel approach, treated in one of the papers, concerned the use of unusual surface arrangements such as wedge-shaped surfaces to reduce the heating rates.

Estimates were given on the atmospheric properties of Mars, Venus, and Jupiter, which will be of value in anticipating the problem of landing on planets.

A number of papers were directed to the subject of space flight, in which the only effective methods of transferring energy to and from the vehicle is by thermal radiation.

A high light was the appearance of several sessions on biotechnology, investigating man's ability to withstand high temperatures and large accelerations. This interest is obviously due to our stated goal of putting a man in space within the next few years.

Coming back to earth, papers included some unusually good reports on combined free and forced convection in channels, while one session presented new experimental data dealing with the influence of nonuniform wall temperatures on heat transfer to aerodynamic surfaces.

Hydraulic. In the area of hydraulic equipment, papers showed the trend toward higher pressures, higher speeds, and welded casing designs with use of improved steels. The Compressor Subcommittee sponsored the second in a series of symposiums, a panel made up of consulting engineers and process designers (next year, the panel will be composed of compressor manufacturers and designers). Emphasis is toward application and reliability.

The Fluid Power Systems Subcommittee presented two papers, pointing up the recent trend toward higher operating pressures. The papers indicated the maturing of the skills in this area.

Special problems on water hammer were discussed in three papers sponsored by the Water Hammer Committee. Developments have been moving away from hydroelectric and water-supply problems, toward newer applications— design of water-cooled nuclear reactors and industrial process plants.

The Pumping Machinery Subcommittee sponsored several papers dealing with problems of net positive suction head, and other papers dealing with performance of standard centrifugal pumps operating as water turbines. This is a growing problem in industry.

A general problem of fluid mechanics running through all the practical applications is that of cavitation. Current interest in cavitation continues to involve water with higher-speed machines, but has also moved into problems arising from the handling of special fluids, such as liquid metals, hydrocarbons, cryogenics, and various exotic rocket fuels.

Behind the Scenes 1959

ASME ANNUAL MEETING

TRANSPORTATION
INFORMATION

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An Annual Meeting needs a lot of staff assistance . . . Registration . . . Sale of Technical papers . . . Tickets . . . Mail and messages . . . Session-room preparations . . . Projectors . . . Blackboards . . . Signs . . . Information . . . Publicity . . . and of great importance, arrangement of meal functions . . .

Instruments and Regulators. This division's papers ranged from the measurement of clothes insulation, through analog-digital computers, to portable spectroscopes. One session was held jointly with the Human Factors Group. At two other sessions, the division joined with the Fluid Meters and Petroleum Groups, and again with the Research Committee on Mechanical Pressure Elements, for presenting papers.

The portable spectroscope just mentioned is for the rapid identification of alloy steels to be subjected to the effects of superheated steam. This is intended for use in the manufacture and replacement of parts in steam-turbine plants where, if a low-strength alloy were inadvertently used in a high-temperature region, it could result in serious damage to the turbine. The paper showed how a spectroscope was modified for use as a portable instrument for sorting alloys.

The Subcommittee on Control Valve Terminology of the ASME-IRD Terminology Committee presented a report on the terminology of diaphragm-operated control valves, covering the physical and operating characteristics of diaphragm-actuated, rising-plug types of control valves suitable for use as final control elements in automatic control systems.

Lubrication. The Lubrication Division presented a review of developments in gas-lubricated bearings; and a progress report on recommended practices for the design of marine-propulsion turbine lubricating systems.

During the year, two trends have been noticeable in the papers of the Division. First is the growing interest in gas-lubricated bearings, centered on the externally pressurized (hydrostatic) type, and the influence of bearing shape and feed restriction on the bearing performance. Second is the continued interest in the application of computers, both digital and analog, to the solution of hydrodynamic-bearing problems. Efforts are being made to account for changes in lubricant viscosity in the bearing film caused by temperature and pressure, and for deflections of both bearing and runner under the film pressure.

Metals Engineering. Subject matter at the Metals Engineering Division sessions ranged from general testing techniques ("Survey of Various Special Tests Used to Determine Elastic, Plastic, and Rupture Properties of Metals at Elevated Temperatures") to test results on specific metals ("Low-Cycle Fatigue of Two Nickel-Base Alloys by Thermal-Stress Cycling"). One paper discussed burst strengths and deformations of welded composite turbine wheels (in which high-alloyed steel is used only in the outer ring, which is welded to a low-alloy inner disk). As a result of the study, fractures could be predicted for wheels containing no significant defects.

A new method of applying high-temperature materials to various surfaces has been evolved, making use of a plasma-spraying technique. The paper describing this device indicated that it is an easily used, economical tool, which is ultimately capable of melting (and vaporizing, if desired) any known material and depositing this material on a surface.

Human Factors. The Human Factors Group, with the Management Division and with the Human Factors Society, contributed six papers in two technical sessions.

How much vehicle vibration can an operator absorb before his performance is affected? How much power can a man generate, using a hand crank or foot pedals—and how much guidance can he give to a vehicle or process while producing manual power? How common is common sense? These were questions brought up by the human-factors papers.

There were two papers on the development of prosthesis (artificial parts for the human body). The engineering problem of replacing arms and hands with mechanical substitutes is an intricate study, and ingeneous designs are being worked out. Research in the biological technologies is progressing toward the grafting of severed limbs, but meanwhile there is a vast research needed for improvements in prosthetics.

New materials, improved methods of harnessing, better functional components, and more effective ways of obtaining comfortable and more functional socket fits are needed. Also better methods of evaluating appliance effectiveness through the measurement of energy expenditures.

Research Committee on Fluid Meters. The Research Committee on Fluid Meters (its origin goes back to 1916) held two sessions, bringing out five papers. Two of them discussed that new differential-pressure metering device, the "quadrant-edge orifice," for metering flows in the lower-Reynolds-number range.

Another device that has come up for attention is the axial-flow turbine-type flowmeter (comparable to a power turbine with zero power output, but actually having quite different design criteria). One of the papers took up the use of the turbine-type meter for viscous fluids.

Engineering for Power

Power Division. Partly by coincidence and partly by perseverance, the Eddystone supercritical-pressure power plant started up the same day that two full sessions were devoted to the research behind the plant's radically new features. A Philadelphia Electric Company official announced between papers that "although I've thought for the last couple of months that the ASME Annual Meeting would come and be gone before we got the plant to work, it is now on the line and finally earning money."

The Eddystone Research Story was the topic of much corridor and elevator conversation. No other single feature of the plant demonstrated the significance of the temperatures and pressures (1200 F, 5000 psi) involved quite as well as the wall thickness of the steam piping (2.4 to 2.86 in. for OD's of only 8.8 to nearly 11 in.). The cross section of the type 316 chromium-nickel-molybdenum stainless-steel piping resembled the barrel of a cannon.

The components and the materials developments from the floating-ring-type stuffing boxes for the boiler-feed pumps to the special filters needed for achieving less than 10-parts-per-billion water purity, and even special temperature-sensing instrumentation, were the topics of the papers presented at these sessions. The conceptual design had been reported at the 1956 ASME Annual Meeting. These were the developmental details.

Other topics were: Steam turbines for marine propulsion and other aspects of marine power engineering; a survey of utility and industrial boiler design; the integration of turbine-driven boiler feed pumps in large power plants; peak shaving economics; an analytical study of two-phase flow of steam; turbine-bearing improvements.

Nuclear Engineering. A. Wyatt of Ontario Hydro and Atomic Energy of Canada Limited, in a discussion of one of the papers, called the turn on the status of nuclear-reactor technology, stating that the problem was no longer the demonstration of the feasibility of nuclear power generation but the achievement of power at costs competitive with fossil fuels.

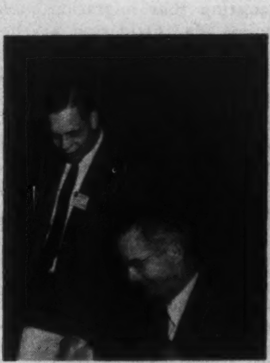
Four of the papers were the result of an Atomic Energy Commission program to determine the "most promising" plant that is now practical for each of the major types of nuclear reactors.

Major cost paring was separately proposed in studies by a Pacific Gas and Electric Company–General Electric Company group and by Sargent and Lundy

Technical Sessions 1959

ASME ANNUAL MEETING

"The authors are to be congratulated on a very fine paper, but . . . says A. J. Tigges, vice-president of Jackson & Moreland



Session Vice-Chairman J. J. Poer of Commonwealth Edison discusses session with Lewis R. Gaty, chairman

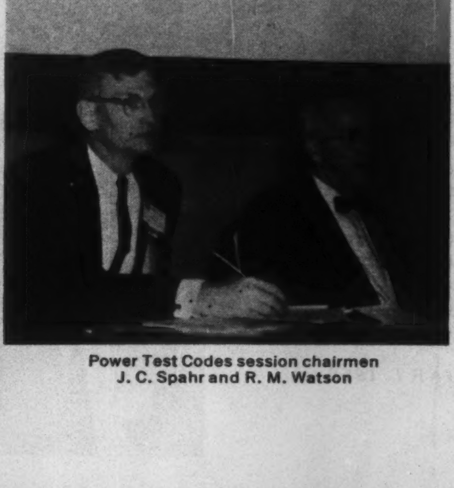
A. Wyatt, of Atomic Energy of Canada Limited, discusses an American heavy-water-reactor proposal, a type on which Canada has the most experience

So many different ideas on how to protect industrial furnaces from explosions have been advocated that as many as 60 relays per burner may be used on a furnace intended for automatic operation. After hearing surveys by the authors **at right,** discussers from this Fuels IV audience suggested that ASME take the lead in developing a Code or Standard for boiler protection.

Author M. L. Jones, principal power engineer for du Pont

Author J. B. Smith of Factory Mutual Engineering Division

Seeing the point—
on the screen—
authors
C. C. Whelchel,
C. H. Robbins,
and chairmen
W. E. Hopkins and
John F. Lee



Power Test Codes session chairmen J. C. Spahr and R. M. Watson which would use pressure suppression to simplify the vapor-containment problem. In the event of rupture of the pressure vessel, steam would be vented into a surrounding pool of water to reduce the pressure to easily containable levels, and make possible cheaper vapor containment.

The Pathfinder Plant being built in South Dakota was conceptually the most interesting of the papers presented, since it achieves nuclear superheat in a region of the core. There is no real barrier between the boiler region and the superheater region and variations in flux vary proportionally once the adjustment of the ratio between the two regions has been effected by the separate control rods provided for this purpose.

A plutonium-fueled fast-breeder reactor was proposed, not as another competing concept, but as a plant which would "fit in a reactor complex" utilizing the plutonium produced by the Enrico Fermi and other plants.

Fuels. Continuing the series on stokers and flame-failure detection presented at the 1957 and 1958 Annual Meetings, the Fuels Division presented two studies on the prevention of boiler explosions during ignition. The development of a Code or Standard was asked to keep the cost of the protective auxiliaries below the cost of the boilers (it is actually more for some smaller designs) and to bring some order to the conflicting ideas of manufacturers, operators, and instrument designers. As many as 60 relays per burner are being installed on boilers for automatic operation, and everyone has a different idea of what is needed. It was suggested that trip be confined to situations requiring protection of equipment and personnel and that alarms be used to announce failures that could be operator corrected. In any case, restart should never be allowed unless the reason for the failure is understood.

The pressurization of solids was the subject of an extensive investigation with implications for other Divisions.

"Model studies" were applied to industrial-gas-flow systems to eliminate expensive dropout. The models are useful in determining minimum values for pressure drop although absolute values are ignored because of the differences in Reynolds number between the model and the full-scale equipment. The models do permit the study of more alternatives through reduced cost.

Reduction of oil-ash corrosion of superheater alloys by the use of additives, the direct method of testing heating and power boilers, and the characteristics and combustion of American and European coals were other topics.

Boiler Feedwater Studies. A panel discussion of corrosion in high-pressure boilers, under the auspices of the Joint Research Committee on Boiler Feedwater Studies included theoretical, operational, metallurgical, chemical, and design information.

Corrosion was divided into two types, those where the products are removed and deposited elsewhere, and those where they are bonded to the metal. After an iron-oxide layer has been formed, it is interesting that migration mechanisms involve: (*a*) Oxidation at the water-iron-oxide and iron-oxide steel interfaces, and (*b*) oxidation at the water oxide interface only, although the reasons are not clear.

In boiler design, the elimination of dissolved oxygen in the feedwater is possibly the key to the elimination of oxide corrosion. Leakproof connections and seal designs are important.

Important also are the avoidance of flow stratification in operation, proper design geometry, and optimum water quality at all phases of operation. Chemical cleaning of boilers is a major preventative.

Even rate of load increase enters the picture: A too rapid increase raises the corrosion rate. Operation in excess of design load was held a major cause—a 10 per cent reduction in load often eliminates any appreciable corrosion.

Shutdown is a major source of oxidation that is often ignored. One Virginia utility guards against it by blanketing the boiler with inert gas during outages, to prevent in-leakage of oxygen. This has been used for storage up to 24 months.

Gas Turbine Power. A completely isolated, uninterconnected generating station that is possibly the only one to use gas turbines exclusively for prime movers was reported. The 25,000-kw Mene Grande, Venezuela, installation uses five identical Westinghouse 5000-kw gas turbines which, with the generators, form self-contained power plants. These can be fully loaded from cold start in a matter of minutes. Reliability of 99.98 per cent has been experienced and an 8.24-mill per kwhr cost achieved.

Gas-turbine reliability-control procedures used by the Bureau of Aeronautics were described. The design and development of a convective air-cooled turbine and test facility was another topic.

Marine applications of gas turbines were described in six papers which included development of a 3500-hp marine gas turbine, development and sea trials of marine Proteus engines, hydrofoil propulsion, COSAG—a combined steam-turbine gas-turbine marine plant—application of industrial gas turbines to marine and mobile uses, and noise-reduction considerations in ship installations.

Solar Energy. A solar turbo power plant, solar air conditioning, solar progress in Japan, and the use of a solar furnace in determining the mechanical properties of materials at very high temperatures were the topics of a session under the auspices of the Solar Energy Applications Committee. The report on Japanese developments will be published in Mechanical Engineering. The solar air-conditioning system couples an ammonia-water absorption system to a flat-plate absorber. The sun would be used to heat water to 140 to 180 F. It was demonstrated to be thermodynamically practical and the near coincidence of maximum cooling load with the period of greatest solar radiation is particularly advantageous.

The solar power plant was designed for operation on the moon, where solar radiation is about $1^{1}/_{2}$ times greater than on earth. A rugged compact unit requiring about 35 sq ft of mirror area per kw was predicated with 890-F mercury inlet temperature to the turbine. A two-dimensional parabolic reflector would direct solar radiation into a boiler tube located at, or near, the focal point of the reflector to provide the high temperatures in the working fluid. Presumably some form of electricity storage would be used to compensate for the long shutdown caused by the lunar night—14 earth days in duration.

Air Pollution. The practicable methods developed by the utility industry for reducing particulate, SO_3, and NO emissions from fuel-oil combustion were described as used by Southern California Edison Company.

The effects of windbox air admittance, oil temperatures, burner tilt, excess air, and gas recirculation on stack emissions from an oil-fired boiler were described.

The Public Health Service presented a review of the current status of air-pollution research in the United States, with emphasis on the physiological effects.

Power Test Codes. The measurement of torque, fluid flow, and temperature in moving fluids were topics of papers at a session under the auspices of the Power Test Codes Committee and the Research Committee on Fluid Meters.

A paper on torque measurement included a survey of available torque-measuring devices and a description of the theory of design and operation of the strain-gage transducer.

The design, manufacture, calibration, and use of 17 nozzles built for accurate

Technical Sessions 1959

ASME ANNUAL MEETING

Technical papers were available at the door to session rooms

Nuclear authors C. T. Chave, **left,** and John B. Anderson

Papers covering advances in Rubber and Plastics held this audience's attention

Panel on corrosion in high-pressure boilers, **left to right,** Mortimer C. Bloom, J. W. Freeman, H. A. Grabowski, J. D. Ristroph, Edward A. Pirsh, Douglas E. Noll

Nuclear Engineering session vice-chairman Myron Beekman, **left,** Detroit Edison, and Chairman W. E. Shoupp, Westinghouse

Nuclear power has been proved practical, now it can become competitive, a capacity audience hears from the authors and discussers

A light moment in the Fuels II session is enjoyed by Session Vice-Chairman A. Bogot, **left,** Combustion Engineering, Inc., and Division Chairman C. F. Kottcamp, Gulf Research and Development Company flow measurement in conducting performance tests on large steam-generator units were presented.

Basic temperatures were defined; recovery factors which account for departures from idealized fluid assumptions were reviewed; and the practical problems of measuring temperature in real moving fluids with real probe were considered in a paper on temperature measurement.

Engineering for Industry

Aviation. The rapid succession of singular achievements in the field of aviation and our familiarity with them cannot diminish the tremendous strides made in this field. The Fifties will go down as the decade of jet transport, the launching of satellites, and a strike on the Moon. With each achievement the state of the art grows, problems become more complex, errors become more costly, and reliability becomes absolutely essential.

The Aviation Division at this Annual Meeting presented a program of 23 papers which highlighted some of the most critical areas in the field: Radar for missiles and satellites, aircraft and missile structures, wind tunnels, jet-transport maintenance, and reliability.

Radar systems that will track high-speed aircraft and satellites came in for discussion with the FPS-35 being singled out. The FPS-35 search radar contains all the refinements now known to be available for use in such equipment and is the largest of its type in this country and possibly in the world. Means for calculating the power to rotate these large antennas under varying wind loads were also noted.

Reliability control, fast evolving as a new science through the joint efforts of government and industry, was discussed in two areas—weapon systems and gas turbines. A number of principles have been established, and implementing procedures are being developed. The application of these procedures already has resulted in a number of successful programs. The unique aspects of the F4H jet-fighter airplane reliability effort were presented and provided an example of a successful reliability program.

Machine Design. The Machine Design Division provided for concentrated discussions on the subjects of gear design and gearing applications. Two of the six sessions were directed to this subject. In general, these papers were intended to give the designer information of broad practical and applicable value. One paper in particular apparently has recognized a special configuration of worm drive, the twinworm drive—a self-locking worm gear transmission of high efficiency, which has not heretofore been discussed in the technical literature.

In the remainder of the sessions, papers considering the basic elements of machines, their design, and application were presented.

Production Engineering. Papers presented by the Production Engineering Division reflected a wide diversity of interest ranging from the science of operations research applied to industrial operations to the photoelastic study of stresses in metal-cutting tools; from discussion of work-handling fixtures to the designing of human industrial environments.

Following the trend of previous years there was much interest in metal cutting and metal-forming problems. Several papers dealt with recent developments in flow-turning and pointed out the advantages of this type of process. Further progress is reported on the correlation of metal properties with their behavior during forming and cutting processes. The studies into the basic laws of metal cutting which were presented are certain to lead to improved productivity of many processes.

Safety. Safety engineering, encompassing as it does the many activities of mechanical engineers, is a broad field. The Safety Division seeks to point out potential sources of work injury in industry and advocates ways to minimize these hazards.

This year the Division sponsored a session jointly with the Materials Handling Division. Emphasis was placed on the proper engineering approach to safety in materials handling and in this connection the value of planning in plant layout was noted.

Railroads. The application of modern techniques, including automation and electronics, continues to be the major trend in the railroad industry. Railroad Division activities reflected this in their program for technical sessions. A symposium on "Cushioned Underframe Designs" also was held along with three other papers related to car impact and cushioning.

Impact damage to equipment in lading has long been a problem and a concern of the railroads. Increased speeds and programs directed toward more efficient utilization of equipment have intensified efforts directed toward a practical solution to this problem.

In addition, there has been a continuous effort to present to the industry the latest techniques in stress analysis of critical materials and components, and in the application of new inspection and repair techniques for railroad equipment. These areas were covered with papers on stresses in wrought steel wheels and traction motors and on ultrasonic inspection of railway car axles.

Petroleum. For many years, the Petroleum Division has attempted to present programs of a general interest aimed at acquainting those nonindustry engineers with the petroleum industry and its future role in meeting world power demands. During the past few years, however, it has become clear that those in attendance at the Annual Meeting Petroleum Sessions are petroleum men and are concerned with specific problems usually unique to the petroleum industry. Effort has been made, therefore, to deal with these problems which in many cases apply equally to problems facing all industries concerned with mechanical design and operating costs. Steam and power supplies for refineries and petrochemical plants, pressure-vessel analysis, and pump standardization were among the subjects treated this year.

Materials Handling. The work of the Materials Handling Division, perhaps more so than any other, is of interest to many other professional divisions. A session sponsored jointly with the Safety Division bears out this point as does a Production Engineering session which deals with a production engineering question with the materials-handling implications. As industry becomes more automated, the materials-handling design problem becomes more a function of machine design. By the same token, as more controls and sensing devices are required, the Division becomes more involved with the concerns of the Instruments and Regulators Division. As a result, the Division is seeking to identify for itself what its future position should be and what unique service it can perform without infringing upon the interests of the other Divisions or of other societies.

The Division's Annual Meeting program reflects in part this conflict, but also suggests a possible solution. This is that ASME, through its Materials Handling Division, be concerned with the creative design aspects of materials-handling problems. And it is here that emphasis has been placed in papers presented at the meeting.

Maintenance and Plant Engineering. Papers presented this year differed from former papers. Rather than dealing with aspects of maintenance or problems in plant engineering, they described training methods and results of the training methods for process-plant operating personnel. They brought to the atten-

Committees 1959

ASME ANNUAL MEETING

The operations of the ASME are made possible by the committee work of a host of engineers whose industries and institutions back them in giving time and energy to the Society. There are more than 5000 men serving on our committees and, over a year, their time and expenses run to seven figures. The other side of the coin: ASME's codes, standards, and other services to industry since the Society's inception have been valued in the billions. During the Annual Meeting at Atlantic City, 172 committee meetings were scheduled, a few of which are pictured here as their members carried on the vital business of The American Society of Mechanical Engineers.

Power test codes: Instruments and apparatus

Region V Vice-Presidents' Advisory and Planning Committee

Petroleum Division: Business Meeting

Constitution and by-laws

Standards: Technical Committee No. 31

tion of plant management methods which will permit operating process equipment immediately upon its installation without the normal break-in or training period on the equipment. These methods will save time and money through the operating personnel's ability to recognize faulty operating conditions and take the necessary steps to correct them before damage occurs to equipment or product.

Rubber and Plastics. Automobile tires that need no air and simple rocket engines that need no expensive valves or tanks were some of the improvements promised by research in the rubber and plastics industry. This year's program tended heavily toward plastics—new plastics and new uses for old plastics. A two-year progress report of rubber developments rounded out the sessions.

Process Industries. A wide range of interests was displayed by this Division which sponsored sessions jointly with the Maintenance and Plant Engineering Division (process simulation); with Management (computer usage); and with Power (low-level economizers). In a single independent session, it displayed similar diversity, treating large-scale chemical nickel coating, sewage-sludge drying, and the effect of transient loads on refrigerated-space temperature.

Management. The trend in management appears, generally, to be toward more mathematical concepts of management control. One paper, in fact, promotes the use of electronic computers in evaluating individual engineers, and another applies statistical theory to the determination of average minimum manufacturing costs particularly during start-up of operation.

There continues to be considerable interest in the engineer as a manager. In sessions held jointly with the Human Factors Group and the Human Factors Society, the Division explored the problems of man in space.

Textile Engineering. Methods for predicting the eventual end-use practicability of an experimental textile fiber before going into pilot production were explained in two of the three papers presented by the Textile Engineering Division. Also treated was the use of textile machines as research tools.

Luncheons and Dinners

President's Luncheon

Speaking on "Meeting the Educational Needs of the Next Twenty Years," at the President's Luncheon, ASME President Glenn B. Warren warned that our educators are facing the following series of serious problems:

1 An expanding student body through elementary school, high school, college, and graduate schools—particularly in the engineering and scientific area.

2 An insufficient number of qualified teachers to meet these needs.

3 Inadequate salary and social status for the teacher.

4 Growing antagonism on the part of the taxpayers to meet with willingness the inevitably growing costs of a proper educational program.

President Warren also told his audience that it is absolutely necessary that at an early date the educators develop and put into use the extensive audio-visual communication and teaching aids to the educational process that modern technology has provided. Here there need be no harmful competition between television and sound motion pictures. The essential thing is that as soon as possible full semester-long recorded films or tapes be prepared by outstanding teachers covering most all high-school and college subjects and many elementary subjects. These should be used on alternate days with automatic or student-aide projection, with the teacher personally handling the class on the intervening days. Other arrangements might be equally sound. In this way, President Warren said, the personal touch so necessary to top-level instruction could be maintained, the enthusiasm of the outstanding educator who prepared the film could be transmitted, adequate lab equipment used, travel and remote area participation in the picture provided, and, what is probably also important, representations to students of hard-to-comprehend parts easily arranged. The films could be kept up to date by insertions or substitution.

President Warren emphasized that a teacher's coverage of students in this way could be doubled or tripled, and we could, therefore, afford to pay them more, as we do others whose effectiveness is increased.

An article based on President Warren's address will appear in a forthcoming issue of MECHANICAL ENGINEERING.

A feature of the President's Luncheon program is the presentation of Honors and Awards to distinguished engineers. At this luncheon the Melville Prize Medal was awarded to Stephen Joy Kline, and the Holley Medal was presented to Maurice J. Fletcher. Both presentations were made by President Warren.

The John Fritz Medal—this year presented at the ASME Annual Meeting—was conferred upon Gwilym A. Price, chairman of the board, Westinghouse Electric Corporation, Pittsburgh, Pa. William F. Ryan, past-president ASME, made the presentation.

Descriptions of the Honors and Awards and biographical sketches of the men who were honored by the Society at this Annual Meeting will be found in the article, "ASME Honors Engineers," on pp. 104–110 in this issue.

Mr. Price is the first man with a non-engineering background to receive the award in its 58-year history.

In his response, Mr. Price explained that American industry needs practical operating experience with the most promising types of atomic power plants to get over the threshold of atomic technology.

"What our industry needs today," he said, "is the tempered cut and thrust of experience—experience in depth and in variety. In some cases, we need to build prototype plants to demonstrate feasibility. The more proved reactor types require successive generations of full-scale plants.

"Shippingport alone, for example, cannot tell us all we need to know about closed-cycle water reactors. We need to develop successively larger nuclear plants. Finally, we need the experience that can come only from operating such plants over a period of years.

"It was less than 11 years ago that the newly formed Atomic Energy Commission contracted with a private company to build the first naval reactor," Mr. Price said. "Today, the United States is well started toward conversion to a nuclear fleet. It has authorized the construction of 33 atomic submarines and three surface vessels. Twelve of these have been launched. Six submarines are in service and have broken all the records. In all, 46 reactor plants have been or are being built for naval propulsion.

"Our country's leadership in atomic naval propulsion is due largely to two main factors. The nation began its program early, and it pursued that program on a steady, continuing basis. It was not a crash program, but rather a sus-

Luncheons and Dinners 1959

ASME ANNUAL MEETING

Coal will maintain its competitive position as a fuel for generation of electricity, according to A. R. Matthews, president, Consolidation Coal Company, Fuels Luncheon speaker

The Hon. Joseph V. Charyk, **left,** Applied Mechanics Dinner speaker, chats with Prof. William Prager

The President's Luncheon—opening function of the 1959 Annual Meeting

Arthur Moody, Mem. ASME, receives certificate announcing establishment of a Hydraulic Division award in honor of his father

G. Dugan Johnson, one of the Old Timers in the Hydraulic Division, drops one of the few old-time quips heard at this year's dinner. Toastmaster J. Robert Groff, **left,** and Division Chairman John Parmakian, **right,** await the thud.

Aladar Hollander, Fellow ASME, receives certificate for presentation to Mrs. Knapp, announcing the award in honor of Robert T. Knapp established by the Hydraulic Division

A radically new approach to engineering education was proposed by Ascher Shapiro, Mem. ASME, at the Hydraulic Dinner tained, stable program of research, design, development, and construction . . . The Navy and the Atomic Energy Commission conducted a program which did not blow out of shape with every gust of wind from the Kremlin."

Also recognized at the Luncheon were the following 1958–1959 ASME Lecturers: Orson L. Anderson, Frank R. Barnett, Hans Conrad, R. N. Hall, Charles Katz, P. Frank Martinuzzi, J. W. Mauchly, and Prof. Paul M. Stafford.

As is the custom at the President's Luncheon, the National President of the Woman's Auxiliary to the ASME reports on the past year's progress. Mrs. Robert W. Worley, outgoing president, in a talk entitled "Caution, Men at Work," briefly summarized the accomplishments of the Auxiliary during its thirty-sixth year. She announced that the Auxiliary now has 28 Sections with a membership of nearly 2000; the increasing achievements in the field of scholarships and student loan funds; and the pledge to the United Engineering Center.

William Littlewood, vice-president, Research and Development Department, American Airlines, Inc., Washington, D. C., presided.

Fuels Luncheon

A. R. Matthews, president of Consolidation Coal Company, Pittsburgh, Pa., speaking on "Coal for Power," at the Fuels Luncheon outlined the changing situation and the future of coal in relation to other sources of fuel, the economy in general, and the uses that will influence the amount of fuel available for electric-power generation.

In summary, Mr Matthews stated that the coal industry is determined to earn the privilege of supplying the major portion of the increased requirements of fuel which will be needed for the expansion of utility plants in its market territory during the next 15 years. "In that task coal relies upon its great reserves and upon its ability to maintain the continuing improvement in its own production efficiency which it has demonstrated its ability to achieve." The output is now 12 tons per man per day, or 90 per cent higher than ten years ago, equalizing the basic wage rate increase from $13.05 to $24.25. The resulting stable pit-head price ($4.90 per ton in 1948, $4.86 in 1958) together with leveled out transportation costs will provide utility customers with a stable and low-cost fuel at the plant bunkers.

"To accomplish this," he stated, "will require the most careful planning of new mine plant and equipment, planning in which the advice and guidance of the utility industry will be invaluable. Utility executives and planning engineers may expect more and more visits from coal operators wanting to discuss mine-development plans to satisfy fuel requirements of five, ten, and fifteen years ahead."

C. F. Kottcamp, chief fuels and lubricants engineer, Gulf Research & Development Company, Pittsburgh, Pa., presided at the luncheon and received a certificate from Incoming ASME President, Walker L. Cisler, in appreciation of his services as chairman of the Fuels Division.

Management Luncheon and Towne Lecture

"The mid-Sixties will mark a significant era—an era in which we shall decide forevermore whether or not we shall remain a free people or whether we shall be enslaved by a totalitarian power that achieves control of space . . . content with memories of things past." So said Lieutenant General James M. Gavin, executive vice-president of Arthur D. Little, Inc., Cambridge, Mass., who gave the Towne Lecture at the Management Luncheon.

There are a number of assumptions, he said, that we may make that will be reasonably applicable to our society in the mid-Sixties:

First, a high degree of automation will characterize industrial practice as well as domestic living. In order that we can get more production, raise the standard of living, and provide more leisure time for the pursuit of other interests, machines will be called upon to perform many of the functions now performed by man. Automation will invade the middle management areas of many industries.

General Gavin also predicted that there will be a widespread use of aircraft for the movement of many commodities now moved by surface transportation. The present high-speed jet aircraft will then be replaced by aircraft flying at speeds of 2000 mph, in excess of Mach 3, at first unmanned with high priority cargo flying as programmed drones and later for the movement of human passengers. This will contribute to a further shrinking of the economic, industrial, and military world bringing us closer together as a people. At the same time our population growth will continue at an exponential rate and the requirements for sustenance and services will likewise continue at a similar rate. It follows, therefore, that in this era the engineer must be a man who looks upon the world as one entity and understand it well. An "adjoining community" must mean more to him than perhaps it meant to Henry Robinson Towne 73 years ago. It must mean another nation and another continent for they will be as close to us then in terms of time and travel as nearby cities were 75 years ago. It also follows, said the general, that the engineer must be a well-informed man, a man reasonably well based in the humanities, a man who is broad-gaged in his outlook, a man whose interest in local affairs is exceeded by his interest in and understanding of national and international affairs. And finally, his numbers, in terms of requirements, will far exceed those of today.

The Towne Lecture was established by ASME in 1925 to give its members an opportunity to hear an outstanding leader reveal his experiences relating to the scientific method in industry or business.

A feature article based on General Gavin's Towne Lecture will appear in a future issue of MECHANICAL ENGINEERING.

Charles A. Jurgenson, vice-president, De Laval Steam Turbine Company and retiring chairman of the Management Division, presided; he was also presented with a certificate of appreciation for his services to ASME by Hugh A. Bogle of E. I. du Pont, incoming chairman of the Division.

President Warren presented the Towne Lecture Certificate to General Gavin.

Descriptions of the Honors and Awards and biographical sketches of the men who were honored by the Society at this Annual Meeting will be found in the article, "ASME Honors Engineers," on pp. 104–110 in this issue.

Metals Engineering Luncheon

"What the Mechanical Engineer said to the Materials Engineer" has not yet been divulged. But, F. G. Tatnall, vice-president, Tatnall Measuring Systems Company, Phoenixville, Pa., speaking on the foregoing subject, did say that there remains plenty of room for further communication. In fact, in an amusing and enlightening talk at the Metals Engineering Luncheon, Mr. Tatnall called for more and better communication between mechanical engineers and materials engineers.

Another event of the luncheon was the presentation of a certificate of appreciation to William E. Trumpler, past-chairman of the Metals Engineering Division. M. J. Manjoine, chairman of the Division, presented the certificate, and introduced incoming Division chairman, W. E. Cooper.

Luncheons and Dinners 1959

ASME ANNUAL MEETING

President W. L. Cisler presides at Members and Students Luncheon

Francis G. Tatnall, speaker at Metals Engineering Luncheon, makes a point

Captain C. H. Meigs, **left,** is interviewed on the Polaris missile at the Heat Transfer Luncheon by Shabad of The New York Times

C. H. Thayer of Sun Oil tells how automation is affecting the industry at Petroleum Luncheon

Head Table at the Machine Design Luncheon where C. E. Crede received the Machine Design Award, **left to right,** ASME Director V. Weaver Smith, J. N. Macduff, J. R. Brand, ASME Secretary O. B. Schier, II, C. E. Crede, Division Chairman C. W. Besserer, ASME President G. B. Warren, J. Huckert, W. H. Browne, R. E. Abbott

Towne Lecturer Lieut. Gen. J. M. Gavin, **left,** is shown with Hugh Bogle, incoming chairman of the Management Division. General Gavin presented the Towne Lecture at the Division's Luncheon.

Petroleum Luncheon

Management must plan ahead for the day when employees will be displaced by automation, said Clarence H. Thayer, Vice-President in charge of manufacturing, Sun Oil Company, addressing the Petroleum Luncheon audience.

Mr. Thayer added, "Mere coexistence is regrettably the rule in relationships between employees and management in far too many organizations.

"No opportunity looms larger than the opportunity to achieve real leadership and teamwork in outproducing our rivals and thus serving the welfare and security of the Republic."

However, Mr. Thayer added, the opportunity will be lost "if management fails in a proper appraisal of its relationship and responsibility to employees.

."We must do more than give employees the facts of life. . .we must provide facts—more than we ever have before—but we must also work to protect the right of every employee to think and act independently.

"We must plan for people with greater care than we plan for machines," he said.

There are several promising areas in the search for lower costs in petroleum refining, he pointed out. One of these is an increasing degree of automation.

"It is unfortunate that automation is popularly regarded as a process whose all-consuming purpose is to replace people with machines," he said.

There are many savings in costs, other than reduction in manpower, which result from automation. But, he noted, unless wage costs per unit of output also can be cut the other savings are offset to such a degree as to discourage the investment in automation with the great benefits it can bring.

T. L. White, chairman, ASME Petroleum Division, presided.

Machine Design Luncheon

The first conferral of the Machine Design Award was made by outgoing ASME President Glenn B. Warren at the Division luncheon. Charles E. Crede, Mem. ASME, associate professor of mechanical engineering at California Institute of Technology, was the recipient for his inspired leadership and eminent achievement in the field of shock and vibration.

In his response, Professor Crede gave a brief history of research in that area. Referring to the large body of new knowledge acquired during the recent war, he stated: "We must learn how to design to withstand random vibration, and how to conduct suitable random-vibration tests. We must know more of the effect of high-frequency vibration on structures, how to make suitable analyses, how to conduct tests. We must explore the application of digital computers to the solution of engineering problems in these areas, to obtain results of engineering usefulness.

"These recent developments are important to the design engineers as well as to the specialist in shock and vibration. The days are gone when a designer could explain his particular problem to an expert in half an hour, and obtain a solution in another half hour.

"Current problems are much too complicated for such an approach. They call for the application of the newly developed concepts to real engineering problems—to obtain answers of engineering usefulness. The designer can play an important role in the further development of the shock and vibration technology by pointing out where the problem areas are—by pinpointing the problem and helping to interpret the result. Only in this way can we consolidate recent developments and obtain useful engineering tools."

Division Chairman C. W. Besserer, assistant program director, Minuteman Program, Space Technology Laboratories, Los Angeles, Calif., presided.

Heat Transfer Luncheon

Captain Charles H. Meigs, USN, head of Navigational Branch, Special Projects Office, Bureau of Ordnance, said at the Heat Transfer Luncheon that the United States would benefit from "unique strategic advantages" after the submarine-based weapon, Polaris, becomes operational this year.

He listed these advantages: Ability to reach "almost any point" of the Eurasian Continent from one of the surrounding seas and the "silent mobility" of the launching nuclear submarine, which make it immune to surprise attack.

Captain Meigs discussed the four-year development of the missile and some of the technical problems encountered. He also stated that of 41 flights 27 were successful, two were unsuccessful, and 12 were partially successful.

The Polaris, an intermediate range ballistic missile (IRBM) with a 1500-mile range, is shot out of the submerged submarine by compressed air, like a torpedo. Above water the missile receives rocket thrust and initial guidance and then follows a bullet-like trajectory to the target after rising to a height of 400 miles.

Descriptions of the Honors and Awards and biographical sketches of the men who were honored by the Society at this Annual Meeting will be found in the article, "ASME Honors Engineers," on pp. 104–110 in this issue.

Captain Meigs said a special problem of sea-based missile launchers was to determine at any moment the precise geographical position of the launching vessel to insure firing accuracy.

This information is obtained by a highly precise automatic instrument known as the Inertial Navigator.

A displacement of as little as one-millionth of an inch of the gyroscope, a freely-rotating wheel that forms the heart of the Inertial Navigator, could cause significant navigational errors and cause the missile to miss its target, Captain Meigs disclosed.

Captain Meigs also said that precautions taken to insure pinpoint alignment of the navigation equipment include high-precision bearing and complex cooling apparatus able to control temperature changes within a hundredth of a degree.

The guests attending the Heat Transfer Luncheon were welcomed by incoming President Cisler. Prof. S. P. Kezios of the Illinois Institute of Technology briefly discussed the new *Journal of Heat Transfer* and urged that the engineers in this field give it their support. Professor Kezios, as retiring chairman of the Heat Transfer Division, was presented with a certificate of appreciation. Mrs. F. F. Buckland, consulting engineer, Gas Turbine Department, General Electric Company, acted as Mistress of Ceremonies.

Members and Students Luncheon

The Members and Students Luncheon of the Annual Meeting is a showcase, for it is here that the great, the near great, and the young who aspire to greatness gather to see and be seen.

Prof. Carl J. Eckhardt of the University of Texas gave the Invocation at the opening of the Luncheon, and Glenn B. Warren, outgoing ASME President, presided.

Mechanical-engineering disciplines, said Mr. Warren, have wider application than any other disciplines. He pointed out that the other fellow's experience is cheaper to you. For example, 553 authors related their experiences at the Annual Meeting, and all their information was available merely by participating or later by reading the Transactions of the ASME. He closed by saying, "Let's don't reinvent the wheel."

Honors and Awards 1959

ASME ANNUAL MEETING

James S. Kishi, **left,** Old Guard Prize winner, is congratulated by W. L. Betts at Members and Students Luncheon as W. A. Shoudy looks on

S. J. Kline, **left,** receives Melville Prize Medal from President G. B. Warren at the President's Luncheon

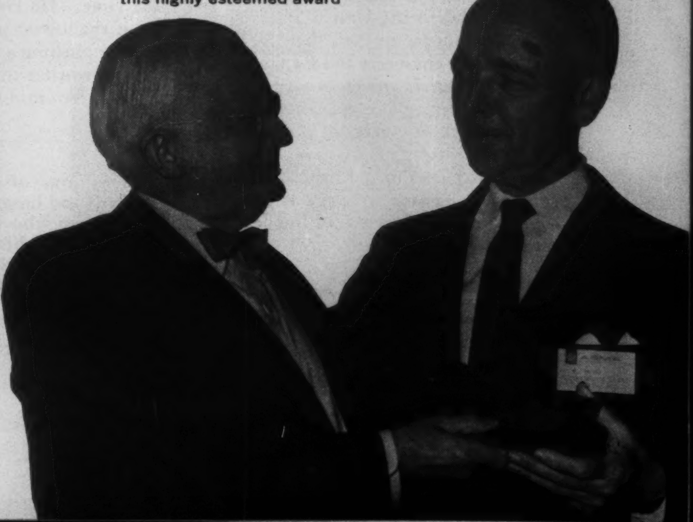
Col. M. J. Fletcher, **left,** receives Holley Medal from President Warren at the President's Luncheon

First Machine Design Award goes to C. E. Crede, **left.** Glenn B. Warren makes the presentation as V. Weaver Smith looks on.

Members and Students approve the honors. W. L. Cisler, **left,** enjoys President Warren's remarks to the Prize Winners: F. C. Borjes, Undergraduate Student Award; R. A. Ghirardini, Arthur L. Williston Medal and Award; and J. L. Benson, Charles T. Main Award.

Prof. D. S. Clark, **left,** of Purdue hands M. E. Merchant the Richards Memorial Award as D. F. Hayes waits to receive the Pi Tau Sigma Gold Medal Award

W. F. Ryan, **left,** past-president ASME, presents the John Fritz Medal to Gwilym A. Price, first nonengineer to win this highly esteemed award



Mr. Warren announced that Drexel, with 45, led the college groups in attendance. The Wayne State University group numbered eight.

James S. Kishi, winner of the Old Guard Prize for his paper on boundary-layer control by suction through distributed perforations, presented his paper to an enthusiastically approving audience. Major Kishi, a senior at the University of Texas, authored the paper that had been chosen from among all the papers presented by Student Members at Regional Conferences throughout the United States and judged the winning paper at the 1958 Semi-Annual Meeting. His paper will be published in a subsequent issue of MECHANICAL ENGINEERING.

Lewis K. Sillcox, past-president and Honorary Member ASME, as chairman of the ASME Board on Honors, presented the recipients of honors and awards. Mr. Warren read the citations and Walker L. Cisler, Incoming President of ASME, conferred the awards. Frederick C. Borjes received the Undergraduate Student Award. James L. Benson of the University of Vermont received the Charles T. Main Award. The Arthur L. Williston Medal and Award went to Lieut. Rowe A. Ghirardini.

Prof. David S. Clark of Purdue University, representing Pi Tau Sigma, undergraduate honorary Society, presented Mylon E. Merchant for the Richards Memorial Award and Donald Frank Hays for the Pi Tau Sigma Gold Medal.

Walker L. Cisler, as Roy V. Wright Lecturer, urged engineers "who speak the same language all over the world" to exert further efforts to reduce tensions.

"Individual efforts, not money, governments, or diplomats alone, can help correct the imbalances that threaten civilization," said Mr. Cisler. "He said that well-qualified private citizens, such as engineers, must assist other nations with their problems of economic development."

Mr. Cisler described his own experiences in helping to thaw the climate of relations between the United States and Russia during a recent visit there. "We found that the engineers and managers of the Soviet electric-power projects were helpful, answering our questions fully. We were taken into areas of the country where our own diplomats have not been permitted to travel in and I think we had this freedom because we came as private citizens and had shown a willingness to meet them on a common basis."

Mr. Cisler said he had been invited to the Kremlin to visit with Deputy Ministers Anastas Mikoyan and Frol Kozlov. They "discussed rather seriously how we might go about building an electric-power plant combining the best of American and Soviet engineering, and to locate this in an underdeveloped country such as India."

The Wright Lecture was established in honor of Roy V. Wright, President of ASME in 1931, as a tribute to his contributions as a citizen to the nation and his community.

A feature article based on Mr. Cisler's Wright Lecture will appear in a future issue of MECHANICAL ENGINEERING.

Mr. Warren presented the Roy V. Wright Lecture Certificate to Mr. Cisler—thus ending this year's Members and Students Luncheon.

Textile Engineering Luncheon

In a well-documented paper, "Value Analysis as a Means for Profit," Donald H. McMillan stated that value analysis is defined as creatively using engineering and manufacturing knowledge to reduce cost without cheapening the product.

"We are all in business to make a profit," said Mr. McMillan of the GE Small A-C Motor and Generator Department. "Consider the relation between profit and costs. Let us assume a profit of 5 per cent net after taxes. To generate an added profit after taxes of $50,000 a year, additional sales of two million dollars are required. The same result can be attained by cutting costs $50,000 and this result probably could be achieved by one value analyst."

Mr. McMillan stated a better understanding of value analysis can be had by considering what these two words mean. For example, "take the common match. It can be used for lighting a cigarette, or a charcoal fire for broiling steak, or for lighting the candles on a birthday cake. Each of these uses bring to us a degree of pleasure. This same match might be used by a trapper in the Maine woods to light a fire that saves him from freezing to death. In which of these cases does the match have the greatest value? From the value analyst's viewpoint, the value is the same. He knows that the actual value is the lowest possible cost of reliably accomplishing a given function."

Of time-to-time cost-cutting programs, Mr. McMillan said the idea is partially right, but two key ingredients are missing—"continuity and value," and the unhappy result often is an actual cheapening of the product which sooner or later is reflected in lost market position, lost volume, and lost profits.

V. F. Sepavich, chairman, ASME Textile Engineering Division, presided at the meeting.

Descriptions of the Honors and Awards and biographical sketches of the men who were honored by the Society at this Annual Meeting will be found in the article, "ASME Honors Engineers," on pp. 104–110 in this issue.

Hydraulic Dinner

Two new awards established by the Hydraulic Division in honor of Robert T. Knapp and Lewis F. Moody were announced at the Hydraulic Dinner. The Moody award will be made annually to the author of an outstanding Division-sponsored paper on a mechanical-engineering, fluid-mechanics study. The Knapp award will be for a paper based on analytical or laboratory fluid-mechanics research.

Professor Knapp's experimental work in cavitation was outstanding. He established and directed the Hydrodynamics Laboratory at the California Institute of Technology where he pioneered in many phases of hydrodynamic research, setting new standards of precision and contributing greatly to hydraulic-laboratory techniques. A certificate describing the award was presented to Aladar Hollander, Fellow ASME, one of Dr. Knapp's long-time colleagues. Professor Hollander was to take the certificate to Los Angeles where it will be presented to Mrs. Knapp at a local Section meeting.

Lewis F. Moody pioneered in high-speed hydraulic turbine and pump development, turbine-draft tubes, and in turbomachinery cavitation investigations while teaching at Princeton University. A certificate describing the award was presented to his son Arthur Moody.

J. Robert Groff, president and general manager of The James Leffel & Company, Springfield, Ohio, was toastmaster at the Hydraulic Dinner. Ascher H. Shapiro, Mem. ASME, professor of mechanical engineering, M.I.T., was the speaker. His topic was "Whither Engineering Education?"

Stating that versatility and adaptability are now the prime requirements of an engineering education, he pointed out that: "The pace of technological development is now so rapid that completely new technologies reach maturation in a decade or less, while older ones take a back seat or disappear. Education in a particular technology was once good for a lifetime, now it is not.

"The intensive research and development effort which is the hallmark of this

Entertainment 1959

ASME ANNUAL MEETING

There was entertainment too . . .
An Early Bird Party . . . A variety
show . . . Informal Tea and
Cocktail Parties . . . Movies . . .
Even dancing . . . On the
boardwalk: Bicycle riding . . .
Rolling chairs . . .
Amusements . . . Shopping . . .

science-engineering revolution blurs the scientific and engineering aspects of a new development. It requires men who can learn and work in a succession of technological areas. It has largely obscured the categorizations 'civil engineering,' 'mechanical engineering,' 'electrical engineering,' which are the reflections of the industrial structure of 50 years ago."

To meet these requirements, Professor Shapiro stated that: "An engineering education of professional type must be liberal, in the classical sense. That is, while transmitting knowledge and information, it should free the intellect of orthodoxy and narrowness of outlook. Above all, it must not produce the inhibitions of which so many forms of traditional engineering education have been guilty."

Applied Mechanics Dinner

The Timoshenko Medal, given for distinguished contributions to the basic engineering science of Applied Mechanics, was awarded this year to Sir Richard Southwell, former rector of the Imperial College, London, England. The presentation was to have been made at the Applied Mechanics Dinner, but because of a serious accident Sir Richard was unable to be present. However, Jerome C. Hunsaker, Professor, Department of Aeronautics at M.I.T, not only introduced Sir Richard in absentia, but he also accepted the award from incoming President Walker Cisler, and then read Sir Richard's response to the audience.

The Applied Mechanics Division always conducts some business during its dinner meeting. William Prager of Brown University, retiring chairman of the Division, who also presided, told the group that the long delay time in printing papers in the *Journal of Applied Mechanics* has been temporarily solved by publishing an additional 64 pages in both the December, 1959, and the March, 1960, *Journals*. Professor Prager reported that the Russian journal, *PMM (Applied Mathematics and Mechanics)* is being completely translated by ASME through funds received from the National Science Foundation.

He also indicated that the Division will in the future invite lecturers to Annual Meetings and Applied Mechanics Conferences.

President Cisler then presented to Professor Prager a certificate of appreciation in testimony of his services as chairman of the Division.

The principal speaker at the function, the Honorable Joseph V. Charyk, Assistant Secretary of the Air Force, Research and Development, Washington, D. C., told the conferees that the rapidly ascendant role of the scientist and the engineer in public life has been an amazing phenomenon of the postwar world. The impact of technology on world affairs is an ever-increasing one, and the future of the world may well rest on the maturity with which these new responsibilities are assesed and discharged. Science has become both a cold war and a hot war weapon. Whether we like it or not, science has become an arena of world conflict. The scientist and the engineer, he said, have become the gladiators in this arena and the world ideological conflict may well be resolved on this battlefield. Science is no respector of any particular ideology, philosophy, or political creed; but its use or misuse, its vitality or its lassitude, its impetus or its disheartenment can easily determine the doctrinal concepts which will dominate the world tomorrow.

Mr. Charyk also discussed briefly the kinds of problems that must be overcome in the development of the Air Force's new weapon systems.

Turning to another point, Mr. Charyk emphasized that the tremendous growth of technology and its important implications in all phases of our life, including the survival of our nation, demands that our scientific and engineering education be virile, responsive, and of the highest caliber. It is shocking to see, he said, even in the curriculums of some of our most respected educational institutions, courses, programs, and subjects that have remained essentially invariant for many years.

Compartmentalization and detailed specific application constitute the bulk of our engineering curriculums. The solid basic foundation in the sciences that is the essence of all engineering application is found all too seldom in the average engineer's program. The classic mathematics, applied mechanics, physics, and chemistry courses in many instances, he pointed out, have been unchanged in their rendition despite the exploding technical nature of the world in which we live today. A proper understanding of modern science and the development of genuine scientific enthusiasm are sadly lacking in most of our secondary and high schools. Technical education must not be allowed to become static. It must not be the mechanical execution of carefully laid-out procedures. Rather, Mr. Charyk concluded, it should create a sincere curiosity, a drive to further exploit and understand, and the development of an ability to meld information from diverse courses and apply it to new and different problems.

Annual Banquet

An atmosphere electrified with hopes—and fears—pervaded the evening as more than 625 ASME members and guests gathered at the Annual Banquet to pay their respects to the men the Society was about to honor with the conferral of Honorary Membership, for this was coincidentally the eve of President Eisenhower's departure on a journey in pursuit of a true and lasting peace. The date: December 3, 1959.

Who could tell better what destruction the alternative could bring than the engineers assembled?

The program of the evening opened with the invocation given by Prof. Carl J. Eckhardt, Fellow ASME, professor of mechanical engineering, University of Texas, Austin, Texas.

Glenn B. Warren, retiring President of ASME, acted as toastmaster.

An innovation at this year's banquet was the presence of ladies at the head table. They were introduced and warmly applauded by the audience. Then the distinguished guests from sister professional societies were presented by O. B. Schier, II, secretary, ASME. Also introduced was Mr. R. W. Worley, General Arrangements Chairman of the 1959 Annual Meeting.

Descriptions of the Honors and Awards and biographical sketches of the men who were honored by the Society at this Annual Meeting will be found in the article, "ASME Honors Engineers," on pp. 104–110 in this issue.

Said Mr. Warren: "It was customary for many, many years to honor distinguished members of our profession at the Annual Banquet. With the growth of our Society, many of these honors have been decentralized to add luster to their presentation and to do more honor to the recipients.

"Other changes have also taken place," he added. "We used to pay

Annual Banquet 1959

ASME ANNUAL MEETING

Admiral Ben Moreell, **left,** and Prof. Thomas B. Drew, **right,** are congratulated by Lewis K. Sillcox, chairman, Board on Honors, on having been made Honorary Members of ASME

Guests arriving for the Banquet Reception . . .

And the President said . . . President Cisler, **left,** checks a story for the Banquet with O. B. Schier, II, **center,** and Glenn B. Warren

International flavor . . . Canadian, Indian, Pakistani, and Americans agree . . . to dine

Garnet T. Page, **left,** general secretary, Engineering Institute of Canada, chats with fellow Canadians, Mrs. Marcus Long and Dr. Long. Dr. Long gave the major address at the Banquet.

. . . "Good Night. This was a delightful evening."

honor by conferring a special membership badge on the members who had attained the completion of fifty years membership in the Society. Now that our Society has a membership exceeding 58,000, this has become a sizable list. Furthermore, these new fifty-year members live in many parts of the country and are unable to attend the Annual Meeting. These fifty-year badges are now presented to them at Section meetings throughout the country."

He then asked the fifty-year members present to rise and be recognized.

Old Guard. The Old Guard, composed of those of 35 or more years of membership, have continued their program of professional development of Students and younger members of the Society.

Under the leadership of Walter L. Betts, chairman of the Old Guard Committee, and William A. Shoudy and Richard North, the Old Guard again arranged for the winners from each of the 12 Regional Student Conferences to meet at the 1959 Semi-Annual Meeting in St. Louis, Mo., and compete for a single national Old Guard prize.

"That session," said Mr. Warren, "was a stimulating experience for those of us who were privileged to attend." He introduced James S. Kishi, winner of this year's prize. He then asked the "Old Guards" to stand so that Mr. Kishi and the other Student Members present might see the men who are helping our students and younger members.

New Council Members—the President. The new members of the Council were introduced. They include: Everett M. Barber of Beacon, N. Y., Clarence C. Franck, Sr., of Philadelphia, Pa., and William H. Larkin of New York City, directors; Charles H. Coogan, Jr., of Storrs, Conn., Donald E. Marlowe of Washington, D. C., Henry N. Muller, Jr., of Hamilton, Ont., Canada, and William C. Heath of San Diego, Calif., vice-presidents. (See MECHANICAL ENGINEERING, August, 1959, pp. 130–135.)

The retiring President introduced the incoming President, Walker Lee Cisler. Mr. Cisler, 79th President of ASME, was greeted with a standing round of applause. He thanked the members for this great honor and pledged his efforts to the good of the Society and its members for the year of his office. Mr. Walker then presented Mr. Warren with the diamond-studded Membership pin—mark of an ASME Past-President.

Honorees. The high mark of the evening—the bestowal of honors. "The recognition of an engineer's work by his fellow engineers is one of his greatest rewards for accomplishment," said Mr. Warren. "Your Society is proud of the honors it bestows; proud of their recipients, and welcomes this opportunity to confer two distinguished honors before such an eminent audience."

Dr. L. K. Sillcox, chairman of the ASME Board on Honors, presented the honorees: Thomas Bradford Drew and Ben Moreell, for Honorary Membership in the Society.

A Philosopher Looks at Engineers. Dr. Marcus Long, principal speaker, asked "Engineers Are People?" With the thoughts and hopes evoked by the President's journey, which may well be the most momentous of our time, it was appropriate to hear one of our good neighbors from Canada give the hard cold facts. True, the facts were couched in congeniality and humor; nevertheless, they were cold and they were hard.

Leaving no doubt that he was "very fond" of engineers, Dr. Long, professor of philosophy, University of Toronto, leveled his guns and took aim—Engineers are too modest. "They do not advertise themselves or their profession. . ." "This modesty," Dr. Long advises, "ought to be abandoned.

"Today largely because of the genius and industry of the engineer," said Dr. Long, "nature has been controlled. It is no longer the master, but the servant of man. On this basis we have built our partially enlightened modern civilization and created a standard of life and comfort and hope never before known to men.

"Nevertheless," Dr. Long said, "it is a saddening thought that the engineer who has played such an outstanding role in the development of civilization, should be the man largely responsible for the destruction of civilization, if it is destroyed.

"The Soviet Union and the West," he added, "confront each other in anger. Each side possesses weapons and the means of delivering them which, if ever used, will likely write the final chapter in the brave story of man. And behind these weapons of destruction stand the engineers of both power-blocs."

This is the engineer's dilemma—loyalty to country demands "more effective weapons of offense and defense; as an engineer, he must use his knowledge of nature for the benefit and improvement of mankind."

Dr. Long had no easy answer to this dilemma; however, he emphatically stated that the answer the engineer should not—cannot—give, is to concern himself only with the engineering problem, and leave the use or misuse of his discovery to others. That answer would mean he had abdicated from his responsibilities as a man.

"The hydrogen bomb will destroy man completely; there are other engineering developments which may spare his body, but destroy his mind if misused."

The major danger to the democratic system of life does not lie with our external enemies, Dr. Long noted. A far greater threat is to be found in the mood of our times. There is a growing concern for economic security—"the sort of security offered by socialism and communism and partially realized in the welfare state" and the search for pleasure.

Life cannot be equated with pleasure. There are responsibilities which must be faced, there are even unpleasant tasks which must be faced. "Our schools have not always recognized this.

"The continuance of the free society does not depend on the will of Mr. Khrushchev; it depends on us and the mood we create."

Mr. Warren adjourned the banquet by asking all to rise and pray in silence for President Eisenhower and a successful trip.

Inspection Trips

National Aviation Facilities Experimental Center. The experimental center of National Aviation Facilities Experimental Center (NAFEC)—a joint project of civil and military aviation interests to do research and development on equipment for automatic flight and landing of airplanes—was visited by more than 100 meeting attendees. The visitors saw the newest types of control and lighting equipment under test. The tour included an inspection of the Electronics and System Analysis Simulation Laboratories and Model Shop and a tour of the flight line.

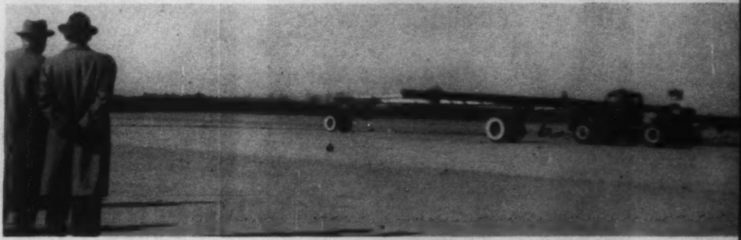
Owens-Illinois Glass Company. A visit to the largest glass container factory in the world was another feature of the 1959 ASME Annual Meeting program. At Owens-Illinois Glass Company, Bridgeton, N. J., visitors saw the automatic manufacture of glass containers ranging in size from vials of a few cubic centimeters capacity to bottles of one gallon capacity. Seen in operation were the automatic conveyers and machinery for the handling and mixing

Inspection Trips 1959

ASME ANNUAL MEETING

NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER

Group inspecting Dutch-designed flush-mounted runway landing lights that guide the pilot on his approach



Propelled at 40 mph by a truck, All American Engineering's "Monster," a rig that duplicates the action of a jet transport landing gear, tests the reaction of a runway arresting gear

Partially installed air-traffic simulator, all electronic. Each console represents an "airplane." Purpose: To solve airport traffic, can repeat an actual day from records.

Another air traffic simulator. "Pilots," by means of Projected spots of light "fly" actual flight patterns, which are picked up by television and fed to "tower" controllers.

More runway lights. . . these are simple to wire in by cutting grooves in the concrete runway

And finally, back to the meeting

of the raw materials, the making of the glass, the molding of the containers, and the inspection, selection, and packing of the final product. Special processes for the coloring and decoration of the various containers were also seen.

Owens-Illinois manufacture, also, the corrugated board cartons used for shipment of their glass containers. The entire process from the making of the corrugated board to the folding, printing, and stapling of the boxes was also inspected.

Brighton Florists. Slightly removed from glass making and automatic manufacturing processes, but equally fascinating was the inspection planned by the Woman's Auxiliary to the ASME. The trip was to Brighton Florists, Linwood, N. J. The greenhouse is devoted exclusively to the growing of orchids and plants of the orchid family. A luncheon followed at the Seaview Country Club.

College Reunions

One of the purely social benefits of the ASME Annual Meeting is the opportunity for College Reunions.

Old grads and not-so-old grads can meet with faculty members of their respective schools to talk over old times, new doings on the campus, receding hairlines, and protruding waistlines.

The alumni of the University of California held a luncheon reunion meeting on Tuesday, December 1. Luncheon reunions were also held by the alumni of the University of North Dakota, Rensselaer Polytechnic Institute, and Stevens Institute of Technology. The Cooper Union alumni met for a dinner get-together on Wednesday evening, December 2, as did the group from Ohio State University. Groups from the University of Michigan, University of Pennsylvania, Purdue University, and Worcester Polytechnic Institute met informally.

Committees in Charge

ASME Meetings come under the general supervision of the Meetings Committee.

The technical program is provided by the Society's professional divisions and technical committees. Other features are planned and supervised by committees organized within the host section—in this case, the ASME Philadelphia Section.

In grateful acknowledgment, the many committees, whose efforts contributed so substantially to the success of the 1959 Annual Meeting follow:

Meetings Committee: W. B. Wilkins, *chairman;* A. M. Gompf; H. N. Muller, Jr.; K. L. Selby; T. S. Fetter, Jr.; B. M. Bailey; E. F. Hoelscher.

Board on Honors: L. K. Sillcox, *chairman;* E. G. Bailey; J. R. Blizard; H. A. Bolz; H. D. Harkins; A. L. Penniman, Jr.; V. Weaver Smith.

Philadelphia Section: W. B. Pegram, *chairman;* T. S. Fetter, Jr., *vice-chairman;* J. T. Evans, *secretary;* J. C. Spahr, *treasurer.*

General Arrangements: R. W. Worley, *chairman.*

Technical Events: A. G. Kisner, *chairman;* J. B. Mochel, *vice-chairman;* R. E. Barney; L. L. Carpenter; J. D. Hagenbuch; B. C. Haskell; W. S. Kirkpatrick; W. F. Machonis; M. C. McKeown; R. E. Mulford; R. W. Munro; R. H. Schenker; B. T. Smythe; R. J. Stock.

Banquet: J. T. Evans, *chairman;* B. W. Webb, *vice-chairman.*

Women's Program: Mrs. Robert W. Worley, *honorary chairman;* Mrs. George S. Gethen, *general chairman;* Mrs. Daniel J. McDonald, Jr., *vice-chairman;* Miss Lucille V. Clarke, *publicity chairman.*

Business Meeting

The annual Business Meeting of The American Society of Mechanical Engineers convened on Nov. 30, 1959, at the Viking Room, in Haddon Hall, Atlantic City, N. J., with Glenn B. Warren, ASME President, presiding.

T. A. Marshall, Jr., senior assistant secretary of ASME, presented high lights from the Annual Report of the Council.

Annual Report High Lights. Mr. Marshall noted that membership in ASME during 1959 reached an all-time high. Including student members, the total as of Sept. 30, 1959, the end of the Society's fiscal year, was 58,421, reflecting in particular the increase in the number of associate members.

By opening its meetings and conferences to members of many other engineering groups, ASME this year took a step toward unity of the engineering profession, a step at a practical level.

Continuing its policy of streamlining meetings and conferences to make them more useful to the members, the Society took steps to more evenly balance the size of ASME's two general meetings—Annual and Semi-Annual. This move has been dictated by the growing size and consequent unwieldiness of recent annual meetings.

In addition, there was further progress in the effort to reduce the number of technical conferences by encouraging joint sponsorship and amalgamation with others. Work initiated three or four years ago began to bear fruit as 32 codes and new and revised standards were published by the Society.

Three new sections were added to the roster of ASME's geographic units during the year, swelling the total to 92. These include Central Virginia, Eastern Virginia, and Northern New Jersey. Five new subsections were formed: Paducah, Ky.; San Antonio, Texas; Ohio Valley; Oak Ridge, Tenn.; and Idaho.

Four new publications launched during the year, *Journal of Heat Transfer*, *Journal of Basic Engineering*, *Journal of Engineering for Industry*, and *Journal of Engineering for Power*, complementing the *Journal of Applied Mechanics* as the five quarterly journals in which the Transactions of the ASME are now published, met with instant acceptance.

Mr. Marshall also reported on the ASME's Medical Group Insurance Plan which has proved highly successful. (See MECHANICAL ENGINEERING, December, 1959, page 135.)

Financially, the Society completed another year of increased activity to members with a balanced budget, it was reported by E. J. Kates, Treasurer.

Both reports—Council and Finance—make up Section 2 of this issue of MECHANICAL ENGINEERING.

Constitutional Amendments. President Warren then called on R. W. Miller, chairman of the Constitution and By-Laws Committee, to report on proposed constitutional changes.

The first two of these changes concern qualifications for admission found in Article C4, Sections 4 and 5. The changes contemplated are to bring the definition in the Constitution exactly in line with the way it is written now on the application blank which is delivered to all prospective members and also to those who will be transferred.

The purpose of the change dealing with requirements for the Affiliate grade also is one of definition and further it deletes the phrase of 30-year age requirement which is given now in the Constitution.

The third change dealt with the designation of the Annual and Semi-Annual Meeting. Upon recommendation of the Board on Technology, the Business Meeting was asked to consider the suggested titles as follows: Winter Annual

The Roving Camera 1959

ASME ANNUAL MEETING

The time of the Annual
Meeting is the time
when ASME members
renew old acquaintances
. . . make new friends
. . . discuss technical
problems . . . or just
ponder over what
to do next . . .

ADVANCE
REGISTR

Meeting and Summer Annual Meeting.

Another change covered a Constitutional Amendment which had been approved at the Business Meeting in St. Louis, Mo. (but not yet sent to the membership in ballot form), which increases the number of members of the Council because of a proposed increase in the number of regions; namely, the quorum requirement of eight members of the Council has been changed to a simple majority.

On a motion from the floor it was approved that the foregoing amendments be put to the membership for ballot.

The Secretary then read the report of the Tellers for the election of Officers, Robert E. Abbott, Frederick H. Linley, and John Weise, and the President called on each newly elected officer to stand.

The officers elected are: Walker L. Cisler, for President; Charles H. Coogan, Jr., Donald E. Marlowe, Henry N. Muller, Jr., and William C. Heath, for Vice-Presidents to serve two years; Everett M. Barber, William H. Larkin, Clarence C. Franck, Sr., for Directors to serve four years.

Biographical sketches of the newly elected officers were published in Mechanical Engineering, August, 1959, pp. 130–135.

United Engineering Center. Mr. Warren called on C. E. Davies, secretary-emeritus ASME, to give a report on the new United Engineering Center. Mr. Davies stated that early in 1959 the site for the new center was cleared completely and exemption from New York State Real Estate Taxes secured. He discussed the necessary changes in the basic plan and reported that Turner Construction Company had been selected as general contractors.

He concluded with a report on the Member Gifts Campaign and the Industry Campaign and the ground-breaking ceremony on Oct. 1, 1959. (See Mechanical Engineering, October, 1959, pp. 73–74; November, 1959, pp. 106–107; December, 1959, pp. 122–123.)

William F. Ryan, chairman of the ASME Members Gifts Campaign, also reported on the ASME Member Gifts Campaign. He said that we have 16 sections that have raised more than their quota. We have only eight who have less than 25 per cent of their quota. . . . and we have some rather dismal pictures in those eight.

"I know everbody here has made a pledge," he added. "The kind of people who come to the Business Meetings and ASME Meetings are professionally minded people who recognize professional responsibilities, and certainly it is a responsibility to complete this building. If the Sections want you to call on anybody; if they want you to participate in the drive as a collector; if they want you to see a particular person whom they think should give a substantial amount, please accept that opportunity—not as an obligation but an opportunity. Help is badly needed by the Sections."

Mr. Warren adjourned the meeting with a special plea for the financial support of the United Engineering Center Member Gifts Campaign.

He also announced that George I. Rockwood had passed away Oct. 30, 1959. Mr. Rockwood was a past-vice-president and the donor of the Holley Medal.

Council Meeting

Actions of the 1959 Council

The Council of The American Society of Mechanical Engineers met in three sessions during the 1959 Annual Meeting in the Garden Room of the Chalfonte-Haddon Hall, Atlantic City, N. J., on November 29, at 8:35 a.m., adjourning at 12:30 p.m.; reconvening in Executive Session at 2:30 p.m.; and in open session at 3:05 p.m. and adjourning at 4:05 p.m.; reconvening on Monday, November 30, at 8:30 a.m. and adjourning at 10:30 a.m.

Attendance. Attendance at all sessions, unless indicated, was as follows:

Council—President, Glenn B. Warren

Past-Presidents, J. N. Landis and W. F. Ryan.

Vice-Presidents, E. W. Allardt, C. H. Coogan, Jr., T. J. Dolan, Harold Grasse, G. R. Hahn, W. C. Heath, J. W. Little, and A. W. Weber.

Directors, E. M. Barber, E. O. Bergman, R. G. Folsom (Monday), E. W. Jacobson, A. M. Perrin, Louis Polk (Sunday), Joseph Pope, L. N. Rowley, R. B. Smith, and V. M. Smith.

Treasurer, E. J. Kates

Council-Elect—Vice-Presidents, D. E. Marlowe and H. N. Muller, Jr. Directors, C. C. Franck, Jr., and W. H. Larkin.

Past-President—D. W. R. Morgan (Sunday afternoon).

Former Members of Council—R. L. Goetzenberger (Monday), W. G. McLean (Sunday afternoon), F. W. Miller (Sunday afternoon), A. C. Pasini, John C. Reed (Sunday afternoon and Monday), C. H. Shumaker (Sunday afternoon and Monday), H. H. Snelling, R. S. Stover (Sunday).

Members of Boards and Committees—L. C. Smith, Organization; R. W. Miller, Constitution and By-Laws; H. E. Martin, Finance (Sunday afternoon); R. C. Allen, Board on Technology (Sunday afternoon and Monday); J. D. Carr, Agenda (Sunday afternoon); R. E. Derby, Public Affairs (Sunday afternoon); T. S. Fetter, Jr., Meetings Committee (Sunday afternoon); and J. W. MacPherson, Membership Development (Monday).

Guests—C. R. Davis (Sunday afternoon and Monday), C. M. Drake, R. L. Nugent (Sunday), L. J. Romzick (Sunday), C. L. Tansil, Jr. (Monday), and F. A. Thomas, Jr. (Monday).

Secretary—O. B. Schier, II (Sunday); secretary-emeritus—C. E. Davies (Sunday afternoon and Monday); senior assistant secretary—T. A. Marshall, Jr. (Monday); and assistant secretaries—W. E. Letroadec, W. E. Reaser, S. A. Tucker, and J. D. Wilding (Sunday).

Staff—J. J. Jaklitsch, Jr., Editor (Sunday); H. I. Nagorsky, Controller; D. B. MacDougall, associate head, Field Service; R. M. Baldini, Staff assistant, Meetings and Divisions (Sunday morning); T. D. Collins, Staff assistant, Meetings and Divisions (Sunday morning); and G. L. Young, District Manager, Central Advertising Sales (Sunday morning).

President Warren introduced the newly elected Members of the Council, and the Secretary introduced the following new members of the staff: Robert M. Baldini and Thomas D. Collins, Staff assistants, Meetings and Divisions; and George L. Young, District Manager, Central Advertising Sales.

The following actions of the Council are of general interest.

Annual Reports. The Annual Report of the Council was adopted and the reports of the Boards, Committees, and representatives on Joint Activities were accepted as submitted. The Annual Report of the Council was mailed to the entire membership with the January, 1960, issue of Mechanical Engineering.

Woman's Auxiliary. The annual and financial reports of the Woman's Auxiliary were received with expressions of sincere appreciation.

Constitution and By-Laws. The Council voted to submit to the Business Meeting, Nov. 30, 1959, constitutional amendments in accordance with the provisions of Article C16, Section 1, for discussion and modification and a vote as to whether the proposed amendments to Article C4,

Business Meeting • Council Meeting 1959

ASME ANNUAL MEETING

The Annual ASME Business Meeting is called to order by President Warren as Senior Assistant Secretary T. A. Marshall, Jr., looks on

R. F. Gagg studies Annual Report during meeting. The Report forms Section 2 of this issue of **Mechanical Engineering.**

ASME Treasurer E. J. Kates, gives financial report

Attendance at this year's Business Meeting was one of the largest ever. On the "Order of Business": High lights of the Annual and Financial Reports; introduction of newly elected officers; a progess report on the new United Engineering Center.

Ralph Miller, chairman of the Constitution and By-Laws Committee, reports to the Council on proposed constitutional changes. ASME Director A. M. Perrin is seated **at right.**

The full Council, the body which administers the affairs of the Society, is shown in session in the Garden Room of the Chalfonte-Haddon Hall

O. B. Schier, II, secretary of ASME, has the floor at this point in three-session Council Meeting. Seated, **left to right,** are Outgoing President Glenn B. Warren and Incoming President Walker L. Cisler.

"The Coffee Break," always a necessity during long Council sessions, finds Roland Stover, **left,** T. J. Dolan, **center,** and E. J. Kates, taking full advantage of the opportunity

Sections 5 and 6; Article C6, Sections 2, 4, and 5; and Article C9, Sections 1, 2, and 4 of the Constitution shall be mailed in printed form to members of the Society for action.

The Council voted to adopt the amendments to Article 6BA, Pars. 15, 17, and 18-c, all of which received first reading on June 14–15, 1959.

The Council voted to receive for first reading the proposed amendments to Article B5, Par. 4; Article B6A, Pars. 10, 11, 12, 13, 14, 14-A 14-B, 14-C, 14-D, 15, 15-A, 15-B, 15-C, 16, 16-A, 17, 17-A, 17-C, 18, 18-A, 18-B-4 18-C, 19, 19-A, and 20; Article B7, Pars 1, 6, 13, 14; Article B9, Par. 1; Article B10, Par. 4; Article B11, Pars. 7 and 9.

The Council vote to refer the proposed amendment to Article B8, Par. 2, back to the Constitution and By-Laws Committee for further study.

The Council also voted to adopt the amendments to the Rules, Article R7, Rule 1; Article R9, Rule 1; Article R10, Rule 2, to become effective when related By-Laws are adopted.

Council Policies. The Council voted to approve Council Policy P-6.4, Qualifications and Duties of ASME Council Members, as revised.

The Council disapproved the proposed change in Council Policy P-4.2 regarding custodian funds of Professional Divisions.

Organization Committee. The Council voted to designate the Organization Committee as the agency responsible for co-ordinating and planning a study of the future growth of the Society and its effects on the Society in all its aspects, and to submit recommendations to the Council as to which specific fields warrant study and investigation in the future and which Society agency should undertake these studies.

Boards and Codes and Standards. The Council approved the enlargement of the Research Planning Committee to include a representative from the Boiler and Pressure Vessel Committee and the Power Test Codes Committee; and refer the matter to the Constitution and By-Laws Committee.

Boiler and Pressure Vessel Committee. Upon recommendation of the Boiler and Pressure Vessel Committee, the Council approved the re-appointment of Henry E. Aldrich as chairman of the Boiler and Pressure Vessel Committee.

Research. Research Contract with U. S. Bureau of Mines. Upon recommendation of the chairman of the Research Committee on Furnace Performance Factors, the Council authorized the Secretary to sign a co-operative agreement between the U. S. Bureau of Mines and ASME for the initial phase of a model test investigation on behalf of the ASME Research Committee on Furnace Performance Factors for the period commencing with the signature date to June 30, 1960. The contract sum is for $2500, for which sufficient funds are available in the custodian fund of the Committee.

Regional Realignment. The Council noted with approval the plan of action of the Vice-Presidents to bring about the earliest practicable implementation of the realignment of the Sections in the western half of the United States into five Regions rather than the present three Regions. The Council believes the plan of action to be in keeping with the Constitution and By-Laws and with the wishes of the membership as expressed through the 1959 Regional Administrative Committee Meetings and the 1959 Regional Delegates Conference.

Sections. Upon recommendation of the Vice-Presidents and with the concurrence of the Chairman of the Organization Committee, the Council approved the formation of the Board on Section Affairs; requested the Organization Committee to study the plan to determine the advisibility of adding Members-at-large; and requested the Committee on Constitution and By-Laws to submit the necessary By-Law change for first reading at the Organization Meeting of the 1960 Council.

Size of Sections. Since the trend toward decentralization of industry is constantly increasing, many ASME members in large metropolitan areas are finding it more difficult to attend Section meetings and derive full benefit from their membership, the Council endorsed the principle that, where local conditions make it desirable, large Sections encourage the creation of subsections and groups whose ultimate aim would be to become Sections so that the needs of the members may be better served.

Re-assignment of Counties From North Texas Section to Mid-Continent Section. The Council approved the re-assignment of the following counties in Texas from the North Texas Section to the Mid-Continent Section, thereby extending the territory of the Amarillo Group of the Mid-Continent Section: Parmer, Castro, Swisher, Briscoe, Hall, Childress, Bailey, Lamb, Hale, Floyd, Motley, Cottle, Cochran, Hockley, Lubbock, Crosby, Dickens, and King.

With the foregoing re-assignment of counties, the Texas Technological College Section (Lubbock, Texas) will be served by the Amarillo Group of the Mid-Continent Section.

Affiliations of Sections With Local Engineering Groups. Upon recommendation of their respective Vice-Presidents, the Council approved 35 affiliations of certain Sections with the local engineering groups in their respective areas.

Student Sections. U. S. Naval Academy Section. Upon recommendation of the Vice-Presidents, the Council voted to disband the ASME Student Section of the U. S. Naval Academy.

Engineers' Council for Professional Development. The Council approved the ECPD revised charter dated Oct. 1, 1959.

Wallace Clark Award. The Council noted that the 1959 Wallace Clark Award was made to Prof. Ir. B. W. Berenschot of The Netherlands.

National Science Foundation. Upon recommendation of the Executive Committee of Engineers Joint Council, the Council voted to support the nominations for membership of the Board of the National Science Foundation as follows: Renomination for a six-year term: Murrough P. O'Brien; nomination for the first time: Eric A. Walker and A. B. Kinzel.

Certificates of Award. ASME Lecturers. Certificates of Award were approved for the following persons: Dr. Orson L. Anderson, Frank R. Barnett, Dr. Hans Conrad, Dr. R. N. Hall, Charles Katz, Dr. P. Frank Martinuzzi, Dr. J. W. Mauchly, and Prof. Paul M. Stafford.

Retiring Committee Chairmen. R. Tom Sawyer, Professional Divisions Executive Committee; Hans H. Wormser, Membership Development Committee; and Charles G. Worthington, Membership Review Committee.

Retiring Professional Divisions Chairmen. William Prager, Applied Mechanics; George Gerard, Aviation; Charles F. Kottcamp, Fuels; Herbert R. Hazard, Gas Turbine Power; Stothe P. Kezios, Heat Transfer; Theodore F. Hatch, Human Factors Group; G. Dugan Johnson, Hydraulic; Donald J. Bergman, Instruments and Regulators; Carl W. Besserer, Jr., Machine Design; Charles A. Jorgensen, Management; James R. Bright, Materials Handling; William E. Trumpler, Jr., Metals Engineering; John R. Menke, Nuclear Engineering; Ervin L. Dahlund, Oil and Gas Power; Henry H. Meredith, Jr., Petroleum, 1958; Thomas L. White, Petroleum, 1959; William E. Hopkins, Power; George S. Stout, Process Industries; Lawrence C. Lander, Jr., Production Engineering; Bruce C. Gunnell, Railroad; Robert D. Stiehler, Rubber and Plastics; Edward A. Reed, Safety; and Linsley G. Brown, Wood Industries.

Retiring Regional Chairmen. E. L. Pace, Sections Committee; R. B. Parker, Student Section Committee; J. M. Bartlett, Jr., Civic Affairs Committee;

and K. E. Scott, Professional Divisions Committee.

Retiring Regional Secretaries. Francis M. Staszesky, Region I; and George R. Leavitt, Region III.

Retiring Faculty Adviser. Raymond Hagglund, ASME Worcester Polytechnic Institute Section.

Retiring Section Chairmen. Homer S. Weber, Atlanta; Harry O. Huss, Baltimore; John J. Shanahan, Boston; Willard P. Berggren, Fairfield; W. C. Belk, Florida; George B. Thom, Metropolitan; Elmer C. Beason, Jr., Mid-Continent; Robert D. Spear, San Francisco; Joseph A. Albert, St. Louis; John T. Davey, Toledo; Fred G. Greaves, Sr., Western Washington; J. A. Jackson, Northeast Florida Subsection; Vernon C. Taylor, Peninsula Subsection; and C. N. Morris, Shreveport Subsection.

Appointments. The following presidental appointments were noted: E. W. Jacobson, NSPE Annual Meeting, Pittsburgh, Pa., Oct. 15–17, 1959. Stewart E. Reimel, Hoover Medal Award Presentation, Washington, D. C., Oct. 21, 1959; Harry R. Kessler, 100th Anniversary Convocation of The Cooper Union, New York, N. Y., Nov. 2, 1959; Stewart E. Reimel, Thomas Alva Edison Foundation meeting, Washington, D. C., Nov. 6, 1959; Rufus Oldenburger, Inauguration of President of Rose Polytechnic Institute, Terre Haute, Ind., Nov. 20, 1959; and D. W. R. Morgan, Inauguaration of President of Temple University, Philadelphia, Pa., Dec. 14, 1959.

Deaths. The Council noted with regret the deaths of John H. Lawrence, Edward L. Cochrane, and George I. Rockwood.

Actions of 1960 Council

The organization meeting of the 1960 Council of The American Society of Mechanical Engineers was held Monday evening, Nov. 30, 1959, at the Chalfonte-Haddon Hall in Atlantic City, N. J. The retiring President, G. B. Warren, called the meeting to order at 8:20 p.m. and introduced A. A. Potter as the senior past-president present as well as the new members of the Council.

Attendance. President, Glenn B. Warren, 1959, and President Walker L. Cisler, 1960; Past-Presidents, W. F. Ryan, 1960 Council, and A. A. Potter, retired; Vice-Presidents, 1960 Council, C. H. Coogan, Jr., T. J. Dolan, Harold Grasse, G. R. Hahn, W. C. Heath, J. W. Little, D. E. Marlowe, and H. N. Muller, Jr.; Vice-Presidents, retired, E. W. Allardt and A. W. Weber; Directors, 1960 Council, E. M. Barber, E. O. Bergman, R. G. Folsom, C. C. Franck, Sr., E. W. Jacobson, W. H. Larkin, A. M. Perrin, L. N. Rowley, R. B. Smith, and V. W. Smith; Director, retired, Joseph Pope; Treasurer, E. J. Kates; Secretary-Emeritus, C. E. Davies; Committee on Staff Personnel, A. C. Pasini; Constitution and By-Laws chairman, R. W. Miller; Senior Assistant Secretary, T. A. Marshall, Jr.; Assistant Secretaries, W. E. Letroadec, W. E. Reaser, S. A. Tucker, and J. D. Wilding.

Mr. Warren presented the "President's Gavel" to Mr. Cisler who took the chair and called the meeting to order.

Past-President Receives Special Pin. The Council expressed to Glenn B. Warren, retiring President, sincere appreciation and thanks for his outstanding accomplishments during his administrative year, during which time he attended many meetings of the Sections, Student Sections, National Meetings of the Society and of sister societies.

President Cisler called upon Past-President Ryan to present the special Past-President's pin to Mr. Warren.

Fellow of the Society. The Council voted to elect Joseph W. Barker, past-president ASME, a Fellow of the Society.

Retiring Members of Council. Each of the retiring members of the Council expressed appreciation for the opportunity of working with their fellow members in serving the Society and the engineering profession. A united plea for financial help for the vice-presidents to better cover their Regions was made by E. W. Allardt and A. W. Weber. Those introduced were: A. W. Weber and E. W. Allardt, Vice-Presidents; and Joseph Pope, Director.

Appointments. The Council made the following appointments: O. B. Schier, II, Secretary of the Society for the year ending Nov. 28, 1960; Thomas A. Marshall, Jr., Senior Assistant Secretary, for the year ending Nov. 28, 1960; Assistant Secretaries for the year ending Nov. 28, 1960, W. E. Letroadec, W. E. Reaser, S. A. Tucker, and J. D. Wilding; Treasurer, Edgar J. Kates; Assistant Treasurer, Harry J. Bauer. Mr. Kates also was appointed Traesurer of the Development Fund.

Executive Committee of the Council. The executive Committee of the Council for 1960 will consist of W. L. Cisler, chairman; T. J. Dolan; H. N. Muller, Jr.; W. H. Larkin; and R. B. Smith.

Assignment of Directors to Boards and Committees. The Council voted to assign Directors and former Members of the Council to Boards and Committees in accordance with Article B6A of the By-Laws as follows (appointments are for one-year terms unless otherwise indicated. New appointments are designated by *): Boards—Codes and Standards, E. O. Bergman (1961) and *C. C. Franck, Sr. (1963); Education, *R. G. Folsom; Honors, *A. M. Perrin; Membership, *L. N. Rowley; Public Affairs, *A. M. Perrin; Technology, E. W. Jacobson (1960), R. B. Smith (1961), R. G. Folsom (1962), and *E. M. Barber (1963). Committees—Finance, W. F. Ryan (1960) and *W. H. Larkin; Organization, *V. W. Smith and *G. B. Warren (1961); Pension, V. Weaver Smith, appointed chairman, to serve a term of three years.

Special Committees of the Council. The Council voted to continue certain special committees and to discharge with thanks and appreciation the Ritual of Engineers Committee.

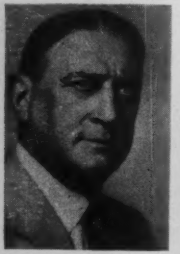
Delegation of Authority to Boards. Certain functions were delegated to the following Boards for one year: Board on Technology, Board on Codes and Standards, and the Board on Honors.

Engineering Index. The present contract with the Engineering Index, Inc., was extended for the year 1960.

Certificate of Award. Upon initiation of his associates and recommendation of Vice-President Grasse, Region VIII, the Council voted to present a certificate of award, under the provision of Council Policy P-6.1, 3(*b*), to Duane Marquis for his work as chairman of the International Petroleum Exposition Engineer's Day Banquet.

1959 ASME Honors Engineers

ASME ANNUAL MEETING



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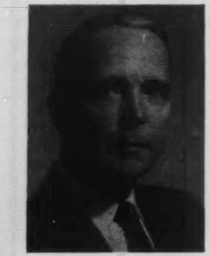

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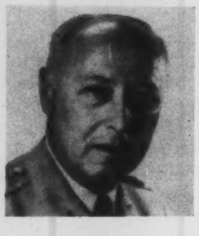

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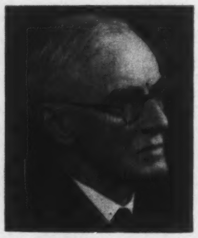


SOUTHWELL

GLASSTONE

KLINE

THE recognition of an engineer's work by his fellow engineers is one of his greatest rewards for accomplishment. This recognition is one of the major purposes of The American Society of Mechanical Engineers.

Through the years it was customary to confer the Society's honors at the Annual Banquet. With the tremendous growth of the engineering profession and the increase in the numbers of such honors, however, it has been decided that decentralization of the presentation of honors would provide opportunity for more members to witness the presentations, and, at the same time, would do more honor to the recipients.

Accordingly, the presentations this year took place at the President's Luncheon on Monday, others at the Applied Mechanics Dinner, the Machine Design Luncheon, the Members and Students Luncheon, and the Banquet. Earlier in the year an award was presented at a special meeting held at The Institution of Mechanical Engineers in London, England; at the Semi-Annual Meeting in St. Louis, Mo.; and the National Power Conference in Kansas City, Mo.

Presentation of the Worcester Reed Warner Medal will be deferred until the Summer Annual Meeting to be held June 5–9, 1960, at Dallas, Texas.

The Society is proud of the honors it bestows and takes this opportunity to congratulate the recipients and to provide the general membership with some information about the honors and the recipients.

# of recipients and description of Honors and Awards bestowed in Atlantic City, N. J.

Honorary Membership

Honorary Membership in ASME was the Society's first honor. It is conferred for acknowledged distinctive accomplishment in engineering, or science, or industry, or research, or public service, and those allied pursuits beneficial to the engineering profession.

Thomas B. Drew

Thomas B. Drew, Mem. ASME, professor of chemical engineering, Columbia University, was honored for distinctive services to government, education, industry, and technical societies in developing the engineering sciences in fluid mechanics, heat transfer, and diffusion.

Professor Drew is currently technical director of the U. S. Atomic Energy Commission's program at Columbia University for heat-transfer studies needed in nuclear reactor design. During World War II, he was active in the Manhattan Project for development of atom power, and he has been associated with Brookhaven National Laboratory since its founding.

He has developed many processes for the study of heat transfer. He also was instrumental in founding the ASME Heat Transfer Division and served as its first chairman.

Ben Moreell

Ben Moreell, Honorary Member ASCE, and director, Jones and Laughlin Steel Corporation, was honored "for his driving force based on faith. His unrelenting effort to realize that faith which has made him such a masterful influence for constructive progress in his community, his state, our nation, and the world at large. The forces which he has sought to bend to good will and reason do not easily yield to imaginative and dedicated statesmanship. But the dreamer in Admiral Moreell has never relented—the dreamer of a dream which gradually becomes reality when brave men have the wisdom and the will to stand firm for the causes they hold sacred."

Admiral Moreell, organizer of the U. S. Navy Seabees during World War II, directed a ten-billion-dollar construction program of shore establishments needed to back up fleet operations.

In the course of his naval career, Admiral Moreell became, at the age of 51, the youngest Vice Admiral in the U. S. Navy. He was the first officer and also the first staff corps officer of the Navy to hold the rank of four-star Admiral who was not a graduate of Annapolis.

After his retirement from the service in 1946, Admiral Moreell was elected president of the Turner Construction Company.

In 1947, he became president and chairman of the board of Jones and Laughlin Steel Corporation. He now has retired from those posts, but remains as a director of the organization. Conferred at Annual Banquet, Thursday, Dec. 3, 1959.

Honors and Awards

JOHN FRITZ MEDAL

The John Fritz Medal was established in 1902, in memory of the iron and steel industry pioneer. It is awarded for "notable scientific or industrial achievements." The medal was founded and is administered by The American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Electrical Engineers, and American Institute of Mining, Metallurgical and Petroleum Engineers. On Oct. 1, 1959, the American Institute of Chemical Engineers assumed a share of responsibility for administering the award.

Gwilym A. Price

Gwilym A. Price, Affiliate ASME, chairman of the board, Westinghouse Electric Corporation, Pittsburgh, Pa., was awarded the John Fritz Medal for 1960 for "his inspirational leadership, industrial pioneering and personal initiative in marshalling the creative forces of research and engineering to the cause of developing atomic power for the national defense and for the human welfare."

Mr. Price is the first nonengineer to receive the medal. Believing in the peacetime value of atomic energy, he formed an atomic power organization within his company which developed for the U. S. Atomic Energy Commission and the Navy the propulsion plants for most of the Navy's growing atomic fleet. These include the *Nautilus*, *George Washington*, and the Navy's first atomic surface ship, the USS *Long Beach*.

The experience he and his engineers gained from work on the atomic submarine was applied to the first full-scale electric generating station at Shippingport, Pa., and to other plants now being built here and abroad. Mr. Price has expressed the hope that these advances will bring closer the day when atomic energy will "overcome and destroy those roots of war—poverty, insecurity, and fear."

A graduate of the University of Pittsburgh Law School, Mr. Price has been a lawyer, banker, and industrialist during his career and has served a term in the state legislature.

He joined Westinghouse as vice-president in 1943, was elected president in 1946, and chairman of the board in 1955. Conferred at President's Luncheon, Monday, Nov. 30, 1959.

HOLLEY MEDAL

The Holley Medal was endowed in 1924 by George I. Rockwood, a past-vice-president of the Society, and named, at his request, for Alexander L. Holley, one of the founders of ASME and the man responsible for bringing the Bessemer process of steelmaking to the United States. The medal is bestowed only for some great and unique act of engineering genius that has accomplished an outstanding and timely public benefit.

Maurice J. Fletcher

Colonel Maurice J. Fletcher, Director, Army Prosthetics Research Laboratory, Walter Reed Army Medical Center, was awarded the Holley Medal "for his valuable contributions to the science of prosthetics, specifically for his inventive genius and engineering skill in designing artificial hand devices to give amputees an opportunity to live a more nearly normal and useful life."

The device which Colonel Fletcher designed enables the amputee to exert any force needed to grasp an object. The range of pressures not only exceeds those which would be physically tolerable with previous devices, but also what is attainable without pain or fatigue by the normal hand.

He has also designed a lock for the mechanical hand which enables it to open and close rapidly, and plastic gloves with skin detail and coloring to go over the hand.

Iowa-born Maurice Fletcher originally was trained for architectural engineering. It was sometime later that he became a registered patent attorney.

In 1931, he was commissioned in the U. S. Army Cavalry Reserve. After World War II, he transferred to the medical branch of the army.

Colonel Fletcher holds many patents on his work. Conferred at President's Luncheon, Monday, Nov. 30, 1959.

WORCESTER REED WARNER MEDAL

The Worcester Reed Warner Medal was established in 1930 by bequest of Worcester Reed Warner, charter member and sixteenth President of the Society. It is awarded for an outstanding contribution to the permanent literature of engineering. In order to qualify for consideration, such literature must be not less than five years old and be recognized as a noteworthy contribution to the profession.

Samuel Glasstone

Samuel Glasstone, consultant, U. S. Atomic Energy Commission, Los Alamos Scientific Laboratory of New Mexico, was awarded the 1959 Worcester Reed Warner Medal "for his outstanding contribution to permanent engineering literature in his writings on atomic energy as exemplified by his book, 'Sourcebook on Atomic Energy'." In making this award the Society also recognized the contribution of Violette F. C. Glasstone, Dr. Glasstone's wife, collaborator, and friendly critic, to the substantive and editorial excellence of the Sourcebook and other writings. In addition to the Sourcebook, Dr. Glasstone is the author of more than 20 other books on nuclear energy, electrochemistry, thermodynamics, and physical chemistry.

Now an American citizen, Dr. Glasstone was born in London, England. He received his BS, MS, PhD, and DS degrees from the University of London.

In 1939, he came to the United States as research associate for Princeton University and has subsequently served as science editor for the Princeton University Press and professor of chemistry at the University of Oklahoma and Boston College. He has been a consultant to many private firms and to the armed forces.

Since 1948, he has acted as consultant to the U. S. Atomic Energy Commission and is also consulting professor in mechanical engineering at the University of New Mexico.

The presentation of the Worcester Reed Warner Medal to Dr. Glasstone will be deferred to the 1960 Summer Annual Meeting in Dallas, Texas, next June.

SPIRIT OF ST. LOUIS MEDAL

The Spirit of St. Louis Medal was established in 1929 by Philip D. Ball, ASME members, and citizens of St. Louis, Mo., and is awarded approximately every three years for meritorious service in aeronautics. The medal is named for Charles Lindbergh's plane.

George S. Schairer

George S. Schairer, vice-president and director of research, Boeing Airplane Company, has received the 1958 Spirit of St. Louis Award for "noteworthy contributions to knowledge and understanding of the complex factors involved in aerodynamic and structural design of very large aircraft, through meticulous analysis and lucid description."

Mr. Schairer is credited with helping to produce a number of aircraft, among them the B-47—America's first multi-engined swept-wing bomber—the Boeing 707 jet liner, and the earlier B-29 and B-50.

He has been with the Boeing Company since 1939, when he joined them to become head of the aerodynamics unit. He previously had been with the Bendix Products Corporation and the Consolidated Aircraft Corporation (Convair).

A graduate of Swarthmore College, from which he holds a degree, and of the Massachusetts Institute of Technology, where he earned an MS degree, Mr. Schairer, along with Mr. Baron, received his award at the Semi-Annual Meeting banquet, June 17, 1959, at the Chase-Park Plaza Hotel. Conferred at Semi-Annual Meeting, June 17, 1959.

TIMOSHENKO MEDAL

The Timoshenko Medal was established in 1957 to be conferred annually in recognition of distinguished contributions to applied mechanics. It was instituted by the Applied Mechanics Division of the Society to honor Stephen P. Timoshenko, world-famed authority in the field, and to commemorate his contributions as author and teacher.

Richard Vinne Southwell

Sir Richard Vinne Southwell, former rector of the Imperial College, London, England, was awarded the Timoshenko Medal "for teaching and research in the application of mathematical and numerical techniques to the solution of practical problems in engineering science."

Sir Richard was born in Norwich, England, and educated at Cambridge and Oxford Universities, from both of which he holds MA degrees.

As a Fellow of Trinity College, Cambridge, superintendent of the Aeronautical Department of the National Physics Laboratory, professor of Engineering Science at Oxford University, and rector of the Imperial College, Sir Richard gained renown as an authority on elasticity, strength of materials, hydrodynamics, and other specialties of applied mechanics. He is the author of several books and more than 100 technical papers.

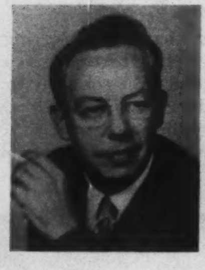
Holder of many honorary degrees and citations by many organizations, Sir Richard is also a foreign associate of the U. S. National Academy of Science. He was the recipient of the ASME Worcester Reed Warner Medal in 1941. Conferred at Applied Mechanics Dinner, Tuesday, Dec. 1, 1959.

Honors and Awards 1959

ASME ANNUAL MEETING

FISHWICK

CREDE



SALISBURY

TOBIAS

SALEMANN

BARON

MACHINE DESIGN AWARD

The Machine Design Award is a new award, established by the Machine Design Division to recognize eminent achievement or distinguished service in the field of machine design.

Charles E. Crede

Charles E. Crede, Mem. ASME, associate professor of mechanical engineering at California Institute of Technology, has won the first Machine Design Award as an "inspired leader in the field of shock and vibration, who through eminent achievement by creative contributions in the research, development, and application of shock mounts, has advanced the field of machine design and furthered the interest and study in shock and vibration control by virtue of technical literature. . . ."

Professor Crede was graduated from the Carnegie Institute of Technology with a BS degree in mechanical engineering and, as Tau Beta Pi Fellow, earned an MS degree in the same field from the Massachusetts Institute of Technology.

His initial industrial experience came as a development engineer at the Standard Railway Equipment Manufacturing Company in Pennsylvania.

In World War II, under U. S. Navy auspices, Professor Crede worked on the development of means to protect shipborne equipment from the severe shocks of warfare, later becoming head of the Navy's new Shock and Vibration Division.

After the war, he became vice-president of Barry Controls, Inc., a company concerned with shock, vibration, and noise control. In September, 1958, he left to become assistant professor at California Institute of Technology.

Professor Crede holds numerous patents on vibration-control devices and is well known as a contributor in his major field to the technical press. Conferral of the award was made for the first time at the Machine Design Luncheon, Wednesday, Dec. 2, 1959.

BLACKALL MACHINE TOOL AND GAGE AWARD

The Blackall Machine Tool and Gage Award is named for Frederick S. Blackall, jr., who served as president of ASME in 1953. It is awarded annually for the best paper or papers submitted to the Society for presentation and publication on a subject clearly concerned with or related to the design or application of machine tools, gages, or dimensional measuring instruments.

The 1958 Blackall Award was conferred on Wilfred Fishwick and Dr. S. A. Tobias, for their paper on "Chatter of Lathe Tools Under Orthogonal Cutting Conditions."

Wilfred Fishwick

Prof. Wilfred Fishwick, professor of electrical engineering at the University College of Swansea in England, has been interested in electrical and mechanical vibrations throughout his professional career. Graduated from Cambridge in 1940, he served during World War II in the RAF in radar development and radio countermeasures. After the war he returned to Cambridge and earned his PhD for his work on mass spectrometers. He spent some time in industry as an instrument engineer and also taught at Edinburgh University.

S. A. Tobias

Dr. S. A. Tobias is assistant research director in the Engineering Department of Cambridge University in England. He received his undergraduate education at the Technological University of Budapest, Hungary, and then was employed as a machine-tool design engineer. He went to England in 1947 and earned his PhD at Edinburgh in 1950. His major fields of interest are linear and nonlinear vibration and machine-tool dynamics. Conferred at The Institution of Mechanical Engineers, London, England, March 20, 1959.

MELVILLE MEDAL

The Melville Prize Medal for Original Work was established in 1914 in honor of Admiral George Wallace Melville, Honorary Member and eighteenth President of the Society. It is awarded annually "for the best original paper or thesis on a mechanical engineering subject by a member of ASME presented for discussion and publication during the preceding calendar year."

Stephen J. Kline

Stephen J. Kline, Mem. ASME, associate professor of mechanical engineering, Stanford University, Calif., was awarded the 1959 Melville Medal for Original Work for his paper "On the Nature of Stall" presented at the ASME Annual Meeting in 1958.

A native of California, Professor Kline was graduated from Stanford University, Phi Beta Kappa, with a BA degree in mechanical engineering.

After three years as an army officer, he joined the company that is now Rocketdyne Division of North American Aviation Corporation, to serve as head of the first turbomachinery preliminary-design group in the Aerophysics Laboratory.

He returned to Stanford for graduate studies in 1948 and earned an MS in mechanical engineering and, at MIT in 1952, a DS degree.

Since that time he has been teaching at Stanford. In addition to his classroom duties, he has supervised a number of research projects in internal flow and thermodynamics.

Professor Kline, who belongs to several technical societies, is the author of more than 30 papers. Conferred at President's Luncheon, Nov. 30, 1959.

PRIME MOVERS COMMITTEE AWARD

The Prime Movers Committee Award was established in 1954 from a fund donated by the Prime Movers Committee of the Edison Electric Institute. It is conferred annually in recognition of outstanding contributions to the literature of thermal electric-station practice or equipment.

J. Kenneth Salisbury

J. Kenneth Salisbury, Fellow ASME, consulting engineer, Atherton, Calif., was awarded the 1959 Prime Movers Committee Award for his paper, "A New Performance Criterion for Steam Turbine Regenerative Cycles," presented at the ASME Annual Meeting in 1958.

Mr. Salisbury began his career in the power field with the General Electric Company in 1930, following his graduation from the University of Michigan. He remained with the company until 1953, when he resigned as manager of GE's Thermal Power Systems Division to become professor of mechanical engineering at Stanford University.

Besides teaching at Stanford, Mr. Salisbury was also manager of the heat and mechanics section of the university's Research Institute.

He established his present private consulting practice in 1956, resigning from the Stanford staff.

This is not the first time ASME has honored Mr. Salisbury. In 1942, he received the Melville Medal for an original paper and, in 1951, the Society selected him as the recipient of the Richards Memorial Award for outstanding achievement in mechanical engineering. Conferred at National Power Conference, Sept. 29, 1959.

JUNIOR AWARD

Presented for the best technical paper delivered before the Society by an Associate Member not more than 30 years of age. The award is made from a fund created in 1914 by Henry Hess, past-vice-president of the Society.

Victor Salemann

For his paper "Cavitation and NPSH Requirements of Various Liquids," Victor Salemann was the 1959 winner of the Junior Award. Mr. Salemann was born in Yugoslavia, educated in German secondary schools, and graduated with an ME degree from Stevens Institute of Technology in 1955.

He is now group supervisor in the Research and Development Section of the Worthington Corporation, where he started as a junior engineer after his graduation.

Mr. Salemann's paper, which was presented at the 1958 Annual Meeting, helped to open up so considerable a field of interest in cavitation in pumping machinery that the Hydraulic Division organized an all-day symposium on the subject for the 1959 Annual Meeting. Conferred at Semi-Annual Meeting, June 17, 1959.

SPIRIT OF ST. LOUIS JUNIOR AWARD

The Spirit of St. Louis Junior Award was established in 1938 by the General Committee for the 1935 Aeronautical Meeting in St. Louis, Mo., and is awarded for the best paper on an aeronautical engineering subject presented at a meeting of The American Society of Mechanical Engineers during the prior three-year period by an Associate Member not more than 30 years of age.

Melvin L. Baron

Melvin L. Baron, Mem. ASME, chief engineer for Paul Weidlinger, consulting engineer, has received the 1958 Spirit of St. Louis Junior Award for his paper, "Response of Nonlinearly Supported Spherical Boundaries to Shock Waves."

Mr. Baron is a graduate of City College of New York, where he received a degree in 1948. He subsequently earned MS and PhD degrees from Columbia University. In addition to his work for Paul Weidlinger, Mr. Baron is currently an adjunct associate professor in civil engineering at Columbia where he has taught since 1951. Previous to his association there, he was a structural designer with Corbett-Tinghir and Company in New York. Conferred at Semi-Annual Meeting, June 17, 1959.

PI TAU SIGMA RICHARDS MEMORIAL AWARD

Given annually for outstanding achievement in mechanical engineering within 20 to 25 years after graduation from college. The award, first presented in 1944, was named in honor of Charles Russ Richards, founder of Pi Tau Sigma.

M. Eugene Merchant

The 1959 Pi Tau Sigma Richards

Honors and Awards 1959

ASME ANNUAL MEETING

MERCHANT

HAYS

GHIRARDINI

BENSON

BORJES

KISHI

Memorial Award has been won by M. Eugene Merchant. New England-born, he is an alumnus of the University of Vermont, where he earned a BS degree in mechanical engineering. Graduate work at the University of Cincinnati won him a DS degree in 1941.

Associated with the Cincinnati Milling Machine Company since that date, Dr. Merchant is now director of physical research there. His work includes basic and applied research on metal cutting, grinding, forming, cutting fluids, friction, and lubrication.

Dr. Merchant's concept of the basic force system in metal cutting is now part of the fundamental theory of the field.

He is credited with a contribution of international significance in the field of friction when he established a simple relationship governing the laws of static friction accounting for the effect of surface roughness.

A Member of ASME and many other professional organizations, Dr. Merchant is past-president of the American Society of Lubrication Engineers. Conferred at Members and Students Luncheon, Thursday, Dec. 3, 1959.

PI TAU SIGMA GOLD MEDAL AWARD

Given annually for outstanding achievement in mechanical engineering within ten years after graduation from college. Achievement may be in any field, including industrial, education, political, research, civic, and artistic.

Donald Frank Hays

The 1959 Pi Tau Sigma Gold Medal Award for outstanding achievement by a young mechanical engineer has been conferred on Donald Frank Hays. A 1951 graduate of Oregon State College, where he received a BS degree in mechanical engineering, Mr. Hays is now affiliated with the General Motors Corporation Research Laboratories.

He is credited with providing the first analytical solution in the study of lubrication of finite journal bearings and he has put his abstract results into concrete form. Mr. Hays holds one patent on his work and has applications pending on others. His texts on lubrication, bearings, and cavitation have appeared in many publications. Conferred at Members and Students Luncheon, Dec. 3, 1959.

ARTHUR L. WILLISTON MEDAL and AWARD

The Arthur L. Williston Medal and Award, established in 1954 by ASME Member Arthur L. Williston, is given for the best thesis by an undergraduate student or a junior engineer on a prescribed topic of changes in, or additions to, engineering college curriculums designed to encourage civic responsibility and interest in constructive social or public activities.

Rowe Angelo Ghirardini

The 1959 recipient of the Arthur L. Williston Medal and Award is Rowe Angelo Ghirardini, who was graduated from Norwich University in Northfield, Vt., in June, 1959. Mr. Ghirardini, who passed his twenty-second birthday in August of 1959, became eligible for the Arthur L. Williston Medal and Award when he submitted his paper "A Joint Responsibility" early in 1959. The paper suggests changes in curriculum and procedure that would heighten the effectiveness and value of courses offered at engineering institutions which also house a unit of the Reserve Officers Training Corps. Mr. Ghirardini's home is in Winchester, Mass. Conferred at Members and Students Luncheon, Thursday, Dec. 3, 1959.

CHARLES T. MAIN AWARD

This award was established in 1919 rom a fund created by Charles T. Main, past-president of the Society; to be awarded for the best paper within the general subject of the influence of the profession upon public life. The exact subject is assigned annually.

James L. Benson

"Professional Attitudes of the Engineer," the essay which won the Charles T. Main Award for James L. Benson, was written while Mr. Benson was a Junior at the University of Vermont. Mr. Benson, whose home is in Essex Junction, Vt., will not receive his bachelor's degree until June of 1960.

In "Professional Attitudes of the Engineer," Mr. Benson discusses such professional problems as ethics, personal responsibility for excellence of work, problems bearing on unity and dignity of the profession, and related topics. His paper was first designated as the best of those submitted in Region I (New England), and later chosen in competition with papers from other parts of the country as the national winner for 1959. Conferred at Members and Students Luncheon, Thursday, Dec. 3, 1959.

UNDERGRADUATE STUDENT AWARD

The Undergraduate Student Award, established in 1914 from a fund created by Henry Hess, past-vice-president of the Society, is presented for the best paper or thesis submitted by a Student-Member.

Frederick C. Borjes

Frederick C. Borjes, a native of New Jersey, was chosen to receive the ASME Undergraduate Award for the excellence of his paper, "Here Comes the A-Plane." Mr. Borjes wrote the paper while an undergraduate at Newark College of Engineering in Newark, N. J., from which school he was graduated in June, 1959.

His paper, which dealt with possible future application of nuclear power to the propulsion of aircraft, was chosen as the best of those submitted in Region I (the New York Metropolitan area) and was later chosen as the outstanding one of those submitted by all of the other seven Regions of the Society. Conferred at Members and Students Luncheon, Thursday, Dec. 3, 1959.

OLD GUARD PRIZE

The Old Guard Prize was established in 1956 and is awarded annually for the best presentation by a Student Member. Winners are selected through a series of regional competitions with a final decision rendered by a panel of judges at the ASME Semi-Annual Meeting. The award is made possible by members of the Society who, through long membership or age, have reached a dues-exempt status, but who contribute funds for worth-while purposes such as this prize.

James Kishi

James Kishi is now working for an aeronautical degree at the University of Texas. He has already completed requirements for the mechanical-engineering degree and will receive both next June.

Mr. Kishi has a practical as well as theoretical interest in aviation, having flown planes for the Army in Korea and on other assignments during his service career. He also piloted the plane used in experiments for his paper and flew himself to the Semi-Annual Meeting, where he won the Old Guard Prize for presentation of his paper, "Boundary Layer Control by Suction Through Distributed Perforations." Conferred at Members and Students Luncheon.

ASME Lecturers, 1958-1959

The ASME Lectures were instituted to bring to Sections of the Society, on a biennial basis, outstanding speakers on subjects of broad general interest and value to members of the mechanical-engineering profession. During the several years that the Lectures have been established, leading scientists and engineers have been selected for this service. The selection is, in itself, an honor. The Lecturer donates his time and receives no honorarium.

The following is a list of the 1958–1959 ASME Lecturers and their topics.

Orson L. Anderson, Bell Telephone Laboratories, Inc., Murray Hill Laboratory, Murray Hill, N. J.
Topic: The Adhesion of Solids.

Frank R. Barnett, Director of Research, The Richardson Foundation, Inc., 122 East 42nd Street, New York 17, N. Y.
Topic: Education, Strategy and Fourth Dimension Warfare.

Hans Conrad, Metallurgy Department, Research Laboratories, Westinghouse Electric Corp., Beulah Road, Churchill Boro, Pittsburgh 35, Pa.
Topic: Design of High Temperature Alloys.

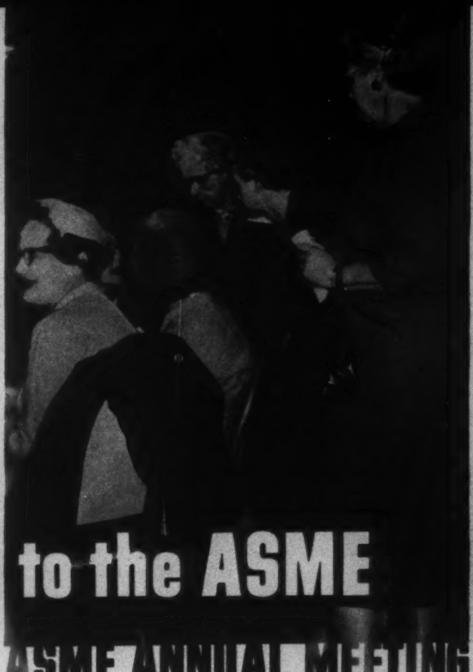
R. N. Hall, Semi-Conductors Studies, General Electric Company, Research Laboratory, P. O. Box 1088, Schenectady, N. Y.
Topics: Properties and Uses of Imperfections in Nonmetallic Crystals, and The Role of Imperfections in Modern Semi-Conductor Technology.

Charles Katz, Remington Rand UNIVAC, Division of Sperry Rand Corporation, 19th Street and West Allegheny Avenue, Philadelphia 29, Pa.
Topic: Computers That Understand English.

P. Frank Martinuzzi, Life Mem., ASME, Professor of Mechanical Engineering, Stevens Institute of Technology, Hoboken, N. J.
Topics: Automotive Gas Turbines, Nuclear Energy, The Future of Atomic Power Plants, and Latest Developments in the Gas Turbine Field.

J. W. Mauchly (Inventor of UNIVAC), Director of Univac Applications, Remington Rand UNIVAC, Division of Sperry Rand Corporation, Post Office Box 5616, Philadelphia 29, Pa.
Topic: The Use of Computers by Engineers.

Prof. Paul M. Stafford, Mem. ASME, Head, Department of General Engineering, South Dakota School of Mines and Technology, Rapid City, S. Dak.
Topics: Creative Imagination, or Engineering Creativeness.



Woman's Auxiliary to the ASME 1959

ASME ANNUAL MEETING

The Annual Meeting of the Woman's Auxiliary to the ASME was held in Atlantic City, N. J., November 29 through December 4. Honorary Chairman of the meeting was Mrs. Robert W. Worley. Three hundred and seventy-seven women registered at Headquarters in Haddon Hall, where they were greeted by "Liberty Bell" hostesses, serving under Mrs. Daniel J. McDonald, Jr., chairman, and Mrs. Wallace E. Belcher, Jr., vice-chairman.

The Philadelphia Section was hostess for the Annual Meeting. Officers of the Annual Meeting Program were: Mrs. George S. Gethen, general chairman; and Mrs. D. J. McDonald, Jr., vice-chairman, and chairman of the Philadelphia Section of the Woman's Auxiliary. Preliminary publicity was covered by Miss Lucille Clarke.

Registration. Registration was held on Sunday, November 29, from 2:00 to 5:00 p.m. in the Stair Lounge, Haddon Hall, and daily afterward from 8:00 am. to 6:00 p.m. Mrs. Frank W. Miller was chairman of registration, assisted by Mrs. Edward S. Bristol, vice-chairman.

Informal Tea. An informal tea on Sunday afternoon was held in the Vernon Room from 4:00 to 7:00 p.m. The table, decorated with white flowers set in tall silver candelabra, was regal and lovely. Five hundred and eight ASMF men and women were present, and renewed old friendships. An excellent orchestra furnished background music. Mrs. Albert Schade, 3rd, was chairman of this successful event.

Coffee Hours. Coffee was served in the Sun Porch from 8:30 to 9:30 a.m. to the ladies on Monday, Tuesday, Thursday, and Friday mornings. Chairmen of these friendly coffee hours were Mrs. Robert W. Worley, Mrs. David E. Tucker, Mrs. Albert Schade, 3rd, and Mrs. Edward C. Kistner; vice-chairmen included Mrs. Theodore N. Graser, Mrs. Charles W. E. Clarke, Mrs. Clarence B. Campbell, Mrs. William L. Corbin, Mrs. Clarence C. Franck, Sr., and Mrs. William E. Karg.

President's Luncheon. In a talk, "Caution, Men at Work," Mrs. Robert W. Worley announced the following accomplishments of the Auxiliary during its thirty-sixth year: The membership has grown to nearly 2000 and there are now 28 Sections; and the Scholarships and Student Aid Funds have grown proportionately. Also, in keeping with the spirit of co-operation—quietly and unobtrusively—the Auxiliary is contributing toward the building of the new United Engineering Center. This report has become, through the years, an outstanding feature of the ASME President's Luncheon.

Auxiliary Workshop. Under the chairmanship of Mrs. Randall B. Purdy and Mrs. Thomas W. Hopper, vice-chairman, the workshop was held on the Sun Porch, Haddon Hall, on Monday afternoon from 2.30 to 3.30 p.m. An unprecedented number attended this meeting which featured a display of Section exhibits for the exchange of ideas.

Outstanding entries were: Cleveland's commemorative plate presented to each of the founding members of the twentieth anniversary of the Section; Detroit's Educational Funds' poster; Metropolitan's monthly publicity flyers, and favorite Liberian recipes made available by the Embassy of Liberia as part of a program sponsored by the Section; Philadelphia's leather-bound memory book, and personalized playing cards. Pittsburgh's gift to the National Board of a three-minute televised film was shown. The film, available for viewing, depicts the Section's Open House for engineering students from the University of Pittsburgh and Carnegie Tech, with Peter Bizon, a Sylvia W. Farny Scholarship recipient, as guest of honor. Columbus Section presented name tags. Two Marjorie Roy Rothermel Memorial Scholarship posters were of special interest. Maps showing Auxiliary Sections; a pamphlet, "Know Your Auxiliary"; and Educational Funds Contributions sheets were distributed.

Variety Show. Monday evening the ASME Philadelphia Section entertained the men and women attending the Annual Meeting with a variety show and dancing in the Carolina Room, Chalfonte Hotel. This was under the direction of Howard Lanin, and was thoroughly enjoyed by everyone there. After the show, prizes were awarded to the lucky persons who had winning numbers.

The men of the Philadelphia Section with their customary geniality and generosity were responsible for this enjoyable evening. We are indebted to them for an outstanding "all star" program, which included Miss Trudy Adams, TV star, who has appeared on the Ed Sullivan hour.

National Board Breakfast and National Board Meeting. Tuesday morning in the Peacock Inn, Haddon Hall, the National Executive Board breakfast, attended by 40 members, was followed by an informal meeting. The need to build up the Calvin W. Rice Memorial Scholarship Fund was emphasized. Mrs. Albert G. Kisner, chairman, and Mrs. James L. Everett, vice-chairman, were in charge of the arrangements.

Kitchen Tour—Chalfonte-Haddon Hall. About 60 women made a behind-the-scenes tour of the hotel kitchens and were shown how a large organization operates and how food is prepared for all the dining rooms.

Annual Tea Dance. The annual Tea Dance was held in the Vernon Room, Haddon Hall. Music filled the air as the curtain rose on the Tea Dance, always a high light on the Program. Moments before the first guests arrived, Howard Lanin's orchestra played softly, the familiar strains of the Auxiliary Theme Song filling the air with the "Spirit of ASME" (arranged in waltz time especially for the occasion). The Vernon Room was a romantic picture in "ballet pink." The festive tea table carried out the motif and the lovely floral centerpiece complemented the silver candelabra. Mrs. Justin J. McCarthy served as chairman of the Tea Dance with Mrs. William E. Karg and Mrs. Garner C. Parr, vice-chairmen. Mrs. Clarence C. Franck, Sr., and Mrs. Homer R. Reese were in charge of the flowers and decorations, and Mrs. Albert G. Kisner in charge of the tickets. Hostesses were Mesdames Stephens, Light, Everett, Cornelius, Miller, Bristol, Schade, and McDonald. Gracing the tea table and pouring were Mesdames Gagg, Purdy, Miller, Landis, Oberg, Hahn, Waltermire, Goetzenberger, Friend, Gibb, Gethen, Estrada, Warren, Cisler, Worley, Graser, McDonald, Parr, and McCarthy.

More than three hundred guests attended this enchanting tea dance.

Card Party. The card party on Tuesday evening was held in the Peverel Lounge of Haddon Hall and was well attended. Men and women enjoying a relaxing bridge game made up 24 tables. A double deck of "ASME" playing cards was given as a table prize.

Mrs. H. Warren Cornelius, Jr., was chairman, and Mrs. Alfred L. Diederich, vice-chairman, for the bridge party.

Annual Business Meeting. The Annual Business Meeting, held Wednesday morning on the Sun Porch, Haddon Hall, with Mrs. Worley presiding, opened with a moment of silent prayer. Presented to the 100 members attending were outgoing ASME President Glenn B. Warren and Mrs. Warren; incoming President Walker Cisler and Mrs. Cisler, who is a member of the Detroit Section. Mr. Warren spoke of the recognition the men had of the value of the Auxiliary to their efforts. Mr. Cisler remarked that he felt much like a shining new penny which needs to be passed through many hands to get the shine off. Both Mr. Warren and Mr. Cisler stressed the importance and need for better education.

Miss E. Sydney Newman, News Editor of Mechanical Engineering, was saluted by Mrs. Worley for her fine work on the magazine and her efforts on behalf of the Auxiliary. Miss Newman "edited" her own remarks making them much too brief, though touched by that quiet humor those of us who know her, know is always present. She assured the ladies of her interest in what they are doing and urged them to continue their much needed effort, and of her co-operation.

Officers and chairmen of Committees gave their reports. Mrs. Herbert Estrada reported a new Central Michigan Section, making a total of 28 Sections. Mrs. George S. Gethen, chairman of the Sylvia W. Farny Scholarship Committee, announced that for the first time one of the four recipients was a woman.

Mrs. Frank W. Miller, chairman of the Marjorie Roy Rothermel Scholarship Committee, announced the first awarding of the scholarship. Mrs. Allen R. Cullimore, chairman of the Calvin W. Rice Memorial Scholarship Committee, and Mrs. Walter F. Friend, Chairman of the Student Loan Fund, reported. Section chairmen or their representatives gave reports indicating the Auxiliary is fulfilling its purpose. (See Mechanical Engineering, December, 1959, pp. 134–135.)

Mrs. C. R. Earle of Chicago reported for the tellers of the election, who included Mrs. G. E. Nevill of Houston, Texas, and Mrs. Rhein Benninghoven of Kansas City. Elected officers are:

President, Mrs. Theodore N. Graser, Boston; First Vice-President, Mrs. John C. Gibb, Metropolitan; Second Vice-President, Mrs. Herbert Estrada, Philadelphia; Third Vice-President, Mrs. Frank Hamilton, Milwaukee; Fourth Vice-President, Mrs. Samuel S. Board, Jr., Buffalo; Fifth Vice-President, Mrs. Bruce Campbell, Inland - Empire; Corresponding Secretary, Mrs. Albert G. Kisner, Philadelphia; Recording Secretary, Mrs. Otto S. Pike, Boston; Treasurer, Mrs. Gordon R. Hahn, Metropolitan; and Assistant Treasurer; Mrs. John W. Wilkenfeldt, Metropolitan.

Before introducing the new officers, Mrs. Worley thanked the officers, Chairmen of Committees, and members, who by working together had made it possible to write "finished" across the far-sighted agenda handed to her by President Mrs. U. A. Rothermel just prior to her death on the eve of the 1957 Annual Meeting.

Past-Presidents Mesdames Landis, Gagg, Purdy, Miller, and Karg were asked to stand with the newly elected officers as they were presented.

Mrs. Graser accepted the gavel with appropriate remarks and named Committee Chairmen. The meeting adjourned with the appointment of the Nominating Committee for next year: Mrs. Ralph Goetzenberger, Washington; Mrs. Charles Crede, Southern California; Mrs. William H. Pugh, Cleveland; Mrs. Allen R. Cullimore, Metropolitan; and Mrs. Berton McCarroll, Providence.

Annual Luncheon. The Annual Luncheon was held in the Rutland Room of the Haddon Hall Hotel. The Philadelphia ladies are to be congratulated upon the exquisite simplicity and beauty of the decoration. Each table contained a handsome centerpiece of pale yellow mums with a lighted candle, which a fortunate "Lady X" at each table won. Beautiful combs in golden metal cases bearing the ASME insignia were favors presented to each in attendance, and also a corsage of the same beautiful mums.

The speakers' table carried out the blue and gold theme. Following the luncheon, Mrs. Gethen, general chairman, made a few remarks and turned the program over to Mrs. D. J. McDonald, chairman of the Philadelphia Section. Mrs. McDonald welcomed the ladies on behalf of the Philadelphia Section. Mrs. Gethen introduced the ladies at the head table and turned the meeting over to Mrs. Estrada, chairman of the luncheon. Mrs. Estrada introduced the speaker, Emilie Jacobson, journalist, lecturer, and actress, who immediately demonstrated her belief in her subject "Laughter, Freedom's Secret Weapon." Miss Jacobson's understanding of various national humor characteristics transmitted itself to an audience which found her remarks both humorous and challenging. Time passed all too quickly. The drawing of the door prizes concluded the meeting. Vice-chairmen assisting Mrs. Estrada were: Mrs. John T. Evans, Mrs. Theodore S. Fetter, Jr., Mrs. Cullen T. Pearce, Mrs. Martin P. Teller, and Mrs. Roy B. Williams.

Movie Night. The movie, "The Helen Morgan Story," was shown in the Viking Room and was thoroughly enjoyed by those who attended.

Trip to Brighton Florists. Thursday morning at 10.30 a.m. buses were waiting to take the men and women on a visit to Brighton Florists in Somers Point. A tour of the greenhouses was made, through the courtesy of Frank Off, who has grown orchids and supplied the local florists for a long time. Every one enjoyed seeing these beautiful flowers in bloom and the numerous colors of the orchids. Mrs. Albert G. Kisner, chairman, and Mrs. James L. Everett, vice-chairman, were in charge of transportation.

Seaview Country Club. Following the tour of the greenhouses, the buses headed toward Seaview where a delicious buffet luncheon was waiting for 151 men and women. Following lunch, Mrs. Marie McCullough presented a millinery show, with models showing the latest for daytime and evening wear. The last half of the show was devoted to audience participation. Six numbers were drawn—five women and one man—and modeled the hat of their choice. Mrs. Herbert Estrada of the Philadelphia Section was voted the best model and was presented with a beautiful hat.

In the absence of Mrs. Bernard C. Berry, chairman, Mrs. Howard G. Kitt acted as chairman, with Mrs. Garner C. Parr and Mrs. Herbert Estrada assisting. Mrs. Robert W. Worley, National President of the Auxiliary, closed the program with "Things for which we are thankful in 1959."

Liberty Bell Hostesses. Liberty Bell hostesses in charge of hospitality for the Annual Meeting were at Ladies' Headquarters throughout the week to meet and assist guests in every possible way. Hostesses were Mesdames Boyer, Braendel, Cobb, Crofoot, Firth, Fowler, Harlow, Ivins, Keene, Keim, Light, Morgan, Pegram, Semon, Sheehan, Stark, Yarnall, and Zavodny.

Flowers and Decorations. Mrs. Clarence C. Franck, Sr., chairman, and Mrs. Homer R. Reese, vice-chairman, were in charge of all floral arrangements. The atmosphere created by this committee with their artistic talent for unusual floral arrangements will long linger in our memory.

Woman's Auxiliary 1959

ASME ANNUAL MEETING

Mrs. J. J. McCarthy, **left**, Tea Dance chairman, with Mrs. W. E. Krag, **right** vice-chairman, greet a guest.
Above inset shows Mrs. G. S. Gethen, general chairman of the Meeting.

President's Ladies, Mrs. W. L. Cisler, **left**, and Mrs. G. B. Warren enjoy a quiet chat before the Informal Tea on Sunday

Mrs. T. N. Graser, **left**, incoming Auxiliary President, pauses to have a cup of tea with Mrs. C. W. E. Clarke, vice-chairman, and Mrs. R. W. Worley, **right**, outgoing Auxiliary President

National Board Breakfast draws a large audience

At the President's Luncheon Mrs. R. W. Worley reports on Auxiliary Progress

Waiting for the first guests to be received at the Tea Dance are Mrs. T. N. Gracer of Boston, Mass., and Mrs. R. W. Worley of Wayne, Pa.

1959 Availability List

ASME ANNUAL MEETING

The papers in this list are available in separate copy form until **Oct. 1, 1960.** Please order only by paper number; otherwise the order will be returned. Copies of these papers may be obtained from the ASME Order Department, 29 West 39th Street, New York 18, N. Y. Papers are priced at **40 cents** each to members; **80 cents** to nonmembers. Payment may be made by check, U. S. postage stamps, free coupons distributed annually to members, or coupons which may be purchased from the Society. Coupons, in books of ten, are $3 to members; $6 to nonmembers.

Air Pollution

59—A-71 Control of Air Pollution From Oil-Burning Power Plants, by H. C. Austin and W. L. Chadwick

59—A-305 The Use of Transparent Scale Models in the Design of Dust-Collector and Gas Duct Systems for Coal-Burning Electric Generating Stations, by E. F. Wolf, H. L. Von Hohenleiten, and M. B. Gordon

59—A-306 Current Status of Air Pollution Research in The United States, by A. C. Stern and Harry Heimann

59—A-308 Effect of Operating Variables on the Stack Emission From a Modern Power Station Boiler, by G. C. Jefferis and J. D. Sensenbaugh

Applied Mechanics

59—A-1 Nonlinear Creep Deformations of Columns of Rectangular Cross Section, by H. H. Bleich and O. W. Dillon, Jr.

59—A-2 Impact and Moving Loads on a Slightly Curved Elastic Half Space, by A. C. Eringen and J. C. Samuels

59—A-3 Earth Motion Beneath a Prescribed Boundary Displacement, by R. C. Geldmacher, J. W. Dunkin, and R. L. Anderson

59—A-4 Stresses in an Ellipsoidal Rotor in a Centrifugal Force Field, by M. A. Goldberg and Michael Sadowsky

59—A-5 A Perturbation Solution of the Equations of Motion of a Gyroscope, by R. Goodstein

59—A-6 Elastic Flexible Cable in Plane Motion Under Tension, by Wen-Hsiung Li

59—A-7 Of the Plastic Flow of Coulomb Solids Beyond Original Failure, by A. W. Jenike and R. T. Shield

59—A-8 Thermal Stresses Owing to a Hot Spot in a Rectangular Strip, by C. W. Nelson

59—A-9 Forced Vibrations of a Circular Plate, by H. Reismann

59—A-10 A Photoelastic Approach to Transient Stress Problems Employing Low-Modulus Materials, by J. W. Dally, W. F. Riley, and A. J. Durelli

59—A-11 An Analytical Method for Locating the Burmester Points for Five Infinitesimally Separated Positions of the Coupler Plane of a Four-Bar Mechanism, by J. C. Wolford

59—A-15 Production of Rotation in a Confined Liquid Through Translational Motion of the Boundaries, by R. R. Berlot

59—A-16 Transient Analysis of Stress-Wave Penetration in Plates, by N. Davids

59—A-17 The Half-Space Under Pressure Distributed Over an Elliptical Portion of its Plane Boundary, by H. Deresiewicz

59—A-18 Coupled Torsional and Longitudinal Vibrations of a Thin Bar, by R. C. DiPrima

59—A-19 Stability of Forced Oscillations With Nonlinear Second-Order Terms, by Chi-Neng Shen

59—A-24 Approximate Synthesis of Spatial Linkages, by J. Denavit and R. S. Hartenberg

59—A-25 On the Elastic Bending of Columns Due to Dynamic Axial Forces Including Effects of Axial Inertia, by E. Sevin

59—A-26 A Theory of Lubrication With Turbulent Flow and its Application to Slider Bearings, by L. N. Tao

59—A-29 Strain-Hardening Solutions to Axisymmetric Disks and Tubes, by N. Perrone

59—A-31 Relaxation of a Cylinder on a Rigid Shaft, by E. A. Davis

59—A-32 Axially Symmetric Extensional Vibrations of a Circular Disk With a Concentric Hole, by O. G. Gustafsson and T. R. Kane

59—A-33 Thermal Stress in a Viscoelastic-Plastic Plate with Temperature-Dependent Yield Stress, by H. G. Landau, J. H. Weiner, and E. E. Zwicky, Jr.

59—A-34 A Unified Criterion for the Degree of Constraint of Plane Kinematic Chains, by B. Paul

59—A-35 Mechanics of the Sheet-Bending Process, by B. W. Shaffer and E. E. Ungar

59—A-36 Correlation of Theoretical and Photothermoelastic Results on Thermal Stresses in Idealized Wing Structures, by H. Tramposch and George Gerard

59—A-44 On the Annular Damper for a Freely Precessing Gyroscope, by G. F. Carrier and J. W. Miles

59—A-45 Elastic Equilibrium of a Plate With a Reinforced Elliptical Hole, by E. Levin

59—A-46 Plane-Stress Unloading Waves Emanating From a Suddenly Punched Hole in a Stretched Elastic Plate, by J. Miklowitz

59—A-47 On the Optimum Design of Shells by R. T. Shield

59—A-60 Dominance of Shear Stresses in Early Stages of Impulsive Motion of Beams, by H. H. Bleich and R. Shaw

59—A-61 On a Dynamical Saint Venant Principle, by B. A. Boley

59—A-62 Classical Normal Modes in Damped Linear Dynamic Systems, by T. K. Caughey

59—A-63 Transient Thermal Stresses in a Semi-Infinite Slab, by W. Jaunzemis and E. Sternberg

59—A-64 Stresses in a Slab Having a Spherical Cavity Under Circular Bending, by Chih-Bing Ling and Chen-Peng Tsai

59—A-65 On The Plastic Behavior of Rotating Cylinders, by F. P. J. Rimrott

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59—A-287 Closing Our Gaps in Our Knowledge of Steam Sampling, by H. Phillips

59—A-301 Results of Steam Sampling Nozzle Tests on Evaporator Vapor, by T. A. Miskimen

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59—A-76 External Corrosion of Superheaters in Boilers Firing High-Alkali Coals, by P. Sedor, E. K. Diehl, and D. H. Barnhart

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Process Industries

59—A-180 Engineering Application of Digital Computers, by H. D. Irwin

59—A-181 Effect of Transient Loads on the Refrigerated-Space Temperature of a Cooling Complex, by C. F. Kayan

59—A-203 Flash Evaporators for the Production of Boiler Make-Up in Power Plant Cycles, by E. F. Stalcup, E. F. Coxe, and R. L. Coit

59—A-222 Design Performance of the Low-Level Economizer, by J. H. Potter and R. C. King

59—A-226 The Low Level Economizer, by S. Jewson

59—A-275 Some Operating Experiences at a Sewage Sludge Drying Plant, by H. A. Naylor, Jr.

59—A-286 Chemical Nickel Plating on a Large Scale by the Kanigen Process, by W. J. Crehan

Production Engineering

59—A-27 Tensile and Short-Time Creep Properties of N-155 Alloy Sheet, by E. C. Bernett

59—A-37 A Photoelastic Analysis of Machining Stresses, by E. Usui and H. Takeyama

59—A-38 Comparisons Between the Shearing Properties of Alpha-Brass as Derived From the Cutting Process and From Static and Impact Torsion Tests, by S. S. Chang and W. B. Heginbotham

59—A-110 Correlation of Bendability of Materials With Their Tensile Properties, by J. Datsko and C. T. Yang

59—A-126 Feedback . . .Consumer to Factory, by R. E. McGarrah

59—A-131 A Critical Comparison of Metal-Cutting Theories With New Experimental Data, by S. Kobayashi, R. P. Herzog, D. M. Eggleston, and E. G. Thomsen

59—A-132 The Role of Friction in Metal Cutting, by S. Kobayashi and E. G. Thomsen

59—A-164 Some Problems of Press Forging Lead and Aluminum, by A. G. MacDonald, S. Kobayashi, and E. G. Thomsen

59—A-165 The Deformation Process in Metal-Cutting, by W. J. McDonald and B. F. Murphey

59—A-173 Analysis of Power Spinning of Cones, by B. Avitzur and C. T. Yang

59—A-204 New Developments in Plant Layout Techniques, by J. M. Apple.

59—A-243 New Developments in the Theory of the Metal-Cutting Process 1—The Ploughing Process in Metal Cutting, by P. Albrecht

59—A-272 Design Concept of Welded-Steel Lathe, by G. M. Sommer

59—A-277 Flow Turning to Increase Strength, Save Weight, and Reduce Costs, by J. H. Peters

59—A-285 Microanalysis of Steel Rule Cutting, by D. F. Eary

59—A-296 Facilities for Handling and Welding Assemblies in the Machinery Industry, by J. Mikulak

59—A-310 Drawability of Sheet Aluminum Alloy 5457, by R. W. Bund

59—A-317 Planning Human Environment Into Industrial Processing, by L. B. Wocholski

Railroad

59—A-13 Dynamic Stresses in Traction Motors Resulting from Defective Gearing, by E. E. Greene and M. A. Pinney

59—A-221 The Santa Fe Shock Control Freight Car, by T. T. Blickle

59—A-224 Increased Cushioning Capacity—A Requirement of Tomorrow's Freight Car, by R. E. Abbott and H. K. Lanning

59—A-227 The Application of Diesel Engines to Industrial Diesel-Electric Locomotives, by R. W. Barrell

59—A-228 Mobile Reflectoscope Inspection of Railway Car Axles Under Rolling Equipment on the Chesapeake and Ohio Railway Company, by M. F. Melrose and T. E. de Vilbiss

59—A-241 Stresses in Wrought-Steel Wheel Rims and Their Relation to Wheel Life, by M. S. Riegel

59—A-249 Impact as Related to Freight-Car and Lading Damage, by W. E. Baillie

59—A-250 Study of Vibration Frequencies Under Impact Conditions, by G. H. Newcomer

59—A-264 Progress in Railway Mechanical Engineering 1958–1959, by D. R. Meier

59—A-312 Cushioning Requirements for Adequate Lading Protection, by W. H. Peterson

Rubber and Plastics

59—A-113 Uniform Two-Way Orientation of Plastic Films, by M. O. Longstreth and Turner Alfrey, Jr.

59—A-261 Plastic Films in Construction and Agriculture, by T. E. Werkema

59—A-309 Rubber Developments: June 1957-June 1959, by L. E. Straka

59—A-313 Plastics Developments 1958–1959, by L. W. Brock

59—A-316 Videne—A Polyester Laminating and Surfacing Film, by C. W. Taylor

59—A-321 Polyethylene Pipe Progress, by A. Stockfleth

59—A-323 Factors Affecting the Long-Term Performance of Polyethylene Plastic Pipe, by W. P. Acton

Safety

59—A-251 Materials Handling Without Accident, by J. C. Webb

59—A-252 Planning Materials - Handling Safety into the Plant Layout, by J. W. Hall

59—A-253 An Engineering Approach to Safety in Materials Handling, by W. J. Byrne

Solar Energy

59—A-74 Solar Turbo Power-Plant Design, by D. B. Mackay and E. L. Leventhal

59—A-79 Analysis of Solar-Furnace Performance in Mechanical Testing at Extremely High Temperatures, by G. S. Leon and M. E. Shank

59—A-276 Solar Air Conditioning With an Ammonia-Water Absorption Refrigeration System, by M. Eisenstadt, F. M. Flanigan, and Erich A. Farber

Textile Engineering

59—A-99 Mechanical Properties of Textile Materials, by E. J. Stavrakas

59—A-115 The Interaction of Textile Structures and High-Speed Textile Processes, by H. M. Morgan

59—A-220 Use of Textile Machines as Research Tools, by J. F. Bogdan

Includes Letters from Readers on Miscellaneous Subjects

COMMENTS ON PAPERS

The Metric System

To the Editor:

The American Geophysical Union's Special Committee for the Study of the Metric System in the United States has noted your publication of our letter "To the Editor" in the April, 1959, issue of Mechanical Engineering, page 122.

Many of the replies to our letter contained helpful suggestions and offered financial assistance if requested.

The September, 1959, issue of Transactions of the American Geophysical Union contains a full report of the Committee, together with an analysis of the replies to the Questionnaire received up to July. As of November, 1959, 1080 have been analyzed. The scientific and engineering field was rather well covered by publication last spring of the Letter or Questionnaire, or both, in eight of the leading journals and magazines of the United States. Briefly, to the most significant question as to whether it would be desirable to replace the English System with the Metric as the "only official system" of weights and measures in the United States, 90 per cent have replied in the affirmative. The average suggested period of transition was about 22 years; this indicates agreement with the Committee on the necessity for a long transition period to avoid economic dislocation through education in the schools, through a normal retirement of presently active older personnel, and through the normal obsolescence of existing equipment.

The Congress of the United States, for the first time in nearly 30 years, is faced with a decision on metric legislation, recently introduced in both Houses. House Bill, HR7401, May, 1959, and Senate Bill, S2420, July, 1959, both call for a feasibility study of the problem by an appropriate Government agency, with fund authorization. A third action of interest is the introduction in July, 1959, of House Concurrent Resolution 364 which would place the Congress on record in favor of the Metric System.

It is apparent that the United States must soon decide whether to change over gradually, during the next generation, to a far simpler and more logical system of weights and measures or to continue to live in comparative isolation with the remaining ten per cent of the world's population not yet under the Metric System.

Floyd W. Hough.[1]

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[1] Chairman, Committee for the Study of the Metric System in the United States, American Geophysical Union, Washington, D. C.

BOOKS RECEIVED IN LIBRARY

Safety in Petroleum Refining and Related Industries

By George Armistead, Jr. Second Edition. 1959, John G. Simmonds and Company, Inc., New York, N. Y. 484 p., 8 × $10^{3}/_{4}$ in., bound. $12.50. The five basic causes of accidents are discussed: misoperation or improper practice; equipment failure; repair of equipment while operating; lightning, windstorms, and the other effects of the elements; improper equipment and miscellaneous causes. In addition, information is given on the provision of special equipment for accident prevention and the protection of facilities, as well as special treatment of detonative combustion, control of oil spills, tank explosion and collapse, and brittle fracture and fatigue of metals. Requirements for the safest practical equipment location and spacing are indicated.

Steam Turbine Operation

By W. J. Kearton. Sixth Edition. 1958, Sir Isaac Pitman & Sons, Ltd., London, England. 453 p., $5^{3}/_{4}$ × $8^{3}/_{4}$ in., bound. 35s. Thermal and mechanical considerations which affect the operation and handling of larger steam turbines are described. Topics discussed include installation, heating and drainage of turbines, lubrication, thrust bearings and their adjustment, governors and governing, starting and stopping of turbines, inspection and overhauling, regenerative feed-heating, erosion of blading in low-pressure stages, supervisory and protective equipment for turbines, and turbine testing.

Structural Design for Dynamic Loads

By C. H. Norris and others. 1959, McGraw-Hill Book Company, Inc., New York, N. Y. 453 p., $6^{1}/_{4}$ × $9^{1}/_{4}$ in., bound. $12.50. An outgrowth of a program held at the Massachusetts Institute of Technology, the papers included are concerned with a more precise evaluation of the effects produced by the dynamic portion of the loading in structural design. Those aspects considered include behavior of materials under dynamic loading, calculation of response of structural systems to dynamic loading, modern computational techniques applicable to response calculations, and the application of structural design and analysis to specific cases involving dynamic loading. Concluding sections summarize the current thinking on earthquake resistant design, and discuss the vibration of girders under traffic loads and the dynamic effects of wind loads.

Technology in American Water Development

By E. A. Ackerman and G. O. G. Löf. 1959, The Johns Hopkins Press, Homewood, Baltimore, Md. 709 p., $6^{1}/_{2}$ × $9^{1}/_{2}$ in., bound. $10. In this volume water-control technology is related to water development and water-policy decisions. A preliminary section on the physical and economic environment of water development is followed by discussions on techniques and technical events affecting the progress of water development, emerging technology and its potential impact on water use, and organizational responses to problems and opportunities for water development introduced by technologic change. Thirty-one case histories are presented to illustrate the concepts involved.

Theory of Machines Through Worked Examples

By G. H. Ryder. 1959, Cleaver-Hume Press, Ltd., London, England. 280 p., $5^{3}/_{4}$ × $8^{3}/_{4}$ in., bound. 21s. Worked-out solutions are presented for about half of the 340 graded questions dealing with such aspects of machine

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design as kinematics (analysis of motion in linkages, gears, and cams), friction clutches, belts, and brakes, inertia forces, and vibrations. A group of miscellaneous problems are grouped together in a chapter entitled "General Dynamic Problems." Brief reviews of principles, formulas, and methods of solution precede each chapter.

ASTM Specifications for Steel Piping Materials

Prepared by ASTM Committee A-1 on Steel. 1959, American Society for Testing Materials, Philadelphia, Pa. 512 p., 6×9 in., paper. $6. Specifications in this compilation cover pipe used to convey liquids, vapors, and gases at normal and elevated temperatures; still tubes for refinery service; heat exchangers and condenser tubes; boiler and superheater tubes. Specifications are also included for certain materials used in pipe and related installations, including castings, forgings, weldings, bolts, and nuts.

Annual Report on the Progress of Rubber Technology. Vol. 22

Published 1958 for the Institution of the Rubber Industry by W. Heffer & Sons, Cambridge, England. 125 p., $7^{1}/_{4} \times 10$ in., bound. 25s. A selective review of developments within rubber technology during the past year. A new section has been added on the manufacture of synthetic rubber, and, as in the past, reviews are provided on planting and production of raw rubber, and latex, properties and applications of latex, chemistry and physics of raw and vulcanized natural rubber, testing and specifications, and compounding ingredients. In addition, a wide variety of rubber products are surveyed.

Automation and Computing

By Andrew D. Booth. 1959, The Macmillan Company, New York, N. Y. 158 p., $5^{1}/_{4} \times 8^{1}/_{2}$ in., bound. $5. Following a historical background of automation and of analog and digital calculation, the author discusses the logical design of calculating machines and the application of digital and analog techniques to automatic process control, machine-tool control, and assembly. The achievements of computing machines in various fields are assessed, including that of sports and translation, and it is shown that automation can play an important part in office procedure and in strategic and economic planning.

Berechnung von Flächengründungen

By Manfred Kany. 1959, Wilhelm Ernst & Sohn, Berlin, Germany. 135 p., $7 \times 9^{3}/_{4}$ in., bound. 35DM. For the design of flat foundations and footings, this book presents a new method for determining base pressures, bending moments, and settlements of spread foundations. A 30-page theoretical section precedes the practical design section which includes a separate section of graphs in a pocket at the back.

The Effect of Radiation on Materials. Vol. 3

Published 1959 as Special Technical Publication No. 233 by the American Society for Testing Materials, Philadelphia, Pa. 168 p., 6×9 in., bound. $4.25. Papers providing new data on dosimetry techniques; radiation facilities and techniques; and radiation effects on reactor materials and various other materials.

Elementary Decision Theory

By Herman Chernoff and Lincoln E. Moses. 1959, John Wiley & Sons, Inc., New York, N. Y. 363 p., $6 \times 9^{1}/_{4}$ in., bound. $7.50. Statistics is introduced as the science of decision making under uncertainty. This method is used to provide a direct and simple method of exhibiting the fundamental aspects of statistical problems. Topics discussed include probability and random variables, utility and descriptive statistics, uncertainty due to ignorance of the state of nature, computation of Bayes strategies, models, testing hypotheses, and estimation and confidence intervals. Classical statistical methodology is not treated, as this volume is intended for those interested in the fundamental concepts underlying statistics. However, it may be used as the basis for further study in statistics.

Elementary Practical Hydraulics of Flow in Pipes

By C. T. B. Donkin. 1959, Oxford University Press, New York, N. Y. 207 p., $5^{3}/_{4} \times 8^{3}/_{4}$ in., bound. $3.40. A combination textbook and reference work intended for those responsible for the design, layout, installation, and operation of the supply, distribution, and circulating systems of liquids. Aspects covered are water at rest and in motion; quantity, velocity, and diameter; viscosity and Reynolds numbers; flow through orifices, over weirs, and in pipes; exponential and logarithmic formulas for the flow of water in pipes; friction in bends and changes of section. Calculations, tables, and charts are duplicated in the British and Metric systems.

Engineering Statistics

By Albert H. Bowker and Gerald J. Lieberman. 1959, Prentice-Hall Inc., New York, N. Y. 585 p., $6^{1}/_{4} \times 9^{1}/_{4}$ in., bound. $11. Statistics are presented as a science for making decisions. Following an introduction to the basic fundamentals of probability and distribution theory, a coverage is provided for both the theoretical aspects and practical applications of the normal distribution; the Chi-square, t, F, binomial and Poisson distributions; significance tests; tests about one and two parameters; estimation; fitting of straight lines; analysis of variance; quality control and sampling inspection. Liberal use is made of Operating Characteristics Curves to assist in grasping more difficult statistical concepts, and selected examples are used to solve a wide variety of typical engineering problems.

Flow Measurement and Control

By W. F. Coxon. 1959, The Macmillan Co., New York, N. Y. 312 p., $5^{1}/_{4} \times 8^{1}/_{4}$ in., bound. $11. Emphasizes practical measurement and control of flow rather than theoretical concepts. Beginning with a classification of fluid meters and with tables of capacities, a discussion of differential head meters is given which includes the derivation of working formulas and explains the use of Reynolds numbers. The book then continues with primary elements for measuring differential pressures, the installation of pressure difference devices, a detailed consideration of weirs of different cross sections and of flumes, and a survey of typical instruments used in the measurement of fluid control. It concludes with automatic control, control of continuous processes, and miscellaneous control installations.

Frames and Arches

By Valerian Leontovich. 1959, McGraw-Hill Book Co., Inc., New York, N. Y. 472 p., $5^{3}/_{4} \times 8^{3}/_{4}$ in., bound. $20. Presents a solution to the analysis of frames or arches of constant or variable cross section which is based on the classical method and is presented in a convenient, practical form. Time required for frame analysis is considerably reduced. Over 400 condensed solutions for 20 principal types of statically indeterminate frames and arches are given, each solution applying to a particular structure and load. The solutions allow almost limitless variation in members' shape or cross section, and can be used in steel, concrete, and wood design. Also included are comprehensive tables and charts to facilitate the analysis of haunched frames and arches. A volume in the Engineering Societies Monographs Series.

ASME BOILER AND PRESSURE VESSEL CODE

Interpretations

The Boiler and Pressure Vessel Committee meets regularly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure: (1) Inquiries are submitted by letter to the Secretary of the Boiler and Pressure Vessel Committee, ASME, 29 West 39th Street, New York 18, N. Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in MECHANICAL ENGINEERING.

(The following Case Interpretations were formulated at the Committee meeting Sept. 18, 1959, and approved by the Board on Nov. 5, 1959.)

Annulment of cases	Reason for Annulment
Case No. 1064	Provisions are included in Par. H-7 (b)

Case No. 1270N-1

(*Reopened*) (*Special Ruling*)

General Requirements for Nuclear Vessels

In the Reply, Par. (3) Revise to read:

(3) All longitudinal and circumferential welded joints of vessels defined in 5 (a), (b), and (d), built under this and subsequent cases dealing with nuclear vessels shall be of the double-welded butt-type or its equivalent and shall be fully radiographed. When fabricated of carbon and low-alloy steel, such vessels shall be stress-relieved, except as outlined in Case No. 1272N.

Proposed Revisions and Addenda to Boiler and Pressure Vessel Code . . .

As NEED arises, the Boiler and Pressure Vessel Committee entertains suggestions for revising its Code. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism. If and as finally approved by the ASME Board on Codes and Standards, and formally adopted by the Council, they are printed in the semi-annual addenda supplements to the Code. Triennially the addenda are incorporated into a new edition of the Code.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Power Boilers, 1959

PAR. P-269 Add the following definitions as footnote 1 to the caption of paragraph:

Safety Valve: An automatic pressure relieving device actuated by the static pressure upstream of the valve and characterized by full opening pop action. It is used for gas or vapor service.

Relief Valve: An automatic pressure relieving device actuated by the static pressure upstream of the valve which opens further with the increase in pressure over the opening pressure. It is used primarily for liquid service.

Safety Relief Valve: An automatic pressure actuated relieving device suitable for use either as a safety valve or relief valve, depending on application.

PAR. P-281(c) Revise to read:

The popping point tolerance plus or minus shall not exceed the following: 2 lb for pressures up to and including 70 lb, 3 per cent for pressures from 71 to 300 lb, 10 lb for pressures from 301 to 1000 lb and 1 per cent for pressure over 1000 lb.

PAR. P-284 Revise to read:

Springs used in safety valve shall not show a permanent set exceeding 1 per cent of their free length 10 minutes after being released from a cold compression test closing the spring solid.

PAR. P-285(a) Revise to read:

The spring in a safety valve in service for pressures up to and including 250 psi shall not be reset for any pressure more than 10 per cent above or 10 per cent below that for which the valve is marked. For higher pressures, the spring shall not be reset for any pressure more than 5 per cent above or 5 per cent below that for which the safety valve is marked.

PAR. P-296 Steam Gages Revise to read:

Each boiler shall have a steam gage connected to the steam space or to the water column or its steam connection. The steam gage shall be connected to a siphon or equivalent device of sufficient capacity to keep the gage tube filled with water and so arranged that the gage can not be shut off from the boiler except by a valve or cock placed near the gage. Where the use of a pipe longer than 10 ft becomes necessary, an exception can be made to this rule and a shut-off valve or cock arranged so that it can be locked or sealed open may be used near the boiler. Such a pipe shall be of ample size and arranged so that it may be cleared by blowing out. Steam gage connections which are filled with water or steam shall be suitable for the maximum allowable working pressure and steam temperature, but, if the temperature exceeds 406 F, brass or copper pipe or tubing shall not be used. The connections to the boiler, except the siphon, shall not be less than $^1/_4$ in. standard pipe size but where steel or wrought-iron pipe or tubing is used, they shall be not less than $^1/_2$ in. inside diam. That portion of the connection used as a siphon next to the steam gage shall be not less than $^1/_4$ in. inside diam.

Form P-4 Manufacturers' Partial Data Report, line numbered 3, Delete reference to parenthetical statement—(Pars. P-101 to P-114, inclusive, or Pars. U-68, U-69, or U-70).

Material Specifications, 1959

The Boiler and Pressure Vessel Committee has approved adding to Section II the following new specifications:

SB-333-58T Nickel Molybdenum Alloy Plate and Sheet
SB-334-58T Nickel Molybdenum Chromium Alloy Plate and Sheet
SB-335-58T Nickel Molybdenum Alloy Rod
SB-336-58T Nickel Molybdenum Chromium Alloy Rod

Low-Pressure Heating Boilers, 1959

PAR. H-43 Add the following definitions as footnote 1 to the caption of paragraph: (*Same as given for Par. P-269*)

PAR. H-44 Add the following definitions as footnote 1 to the caption of paragraph: (*Same as given for Par. P-269*)

PAR. H-96 Add the following definitions as footnote 1 to the caption of paragraph: (*Same as given for Par. P-269*)

PAR. H-97 Add the following definitions as footnote 1 to the caption of paragraph: (*Same as given for Par. P-269*)

Miniature Boilers, 1959

PAR. M-16 Add the following definitions as footnote 1 to the caption of paragraph: (*Same as given for Par. P-269*)

Unfired Pressure Vessels, 1959

PAR. UG-125 Add the following definitions as footnote 1 to the caption of paragraph: (*Same as given for Par. P-269*)

PAR. UG-131 Renumber present subparagraph (c) as (c)(1) and add a new subparagraph (c)(2) to read:

Capacity certification of pilot operated safety and relief valves may be based on tests without the pilot valves installed, provided prior to capacity tests it has been demonstrated by test to the satisfaction of the official observer that the pilot valve will cause the main valve to fully open within 110 per cent of the set pressure of the main valve and that the pilot valve in combination with the main valve will meet all the requirements of the Code.

TABLE UCS-23 Add the materials and stress values given below.

TABLE UCS-27 Add the material and stress values given below.

TABLE UHA-23 Add the materials and stress values given below.

Welding Qualifications, 1959

Table Q-11.1 Under designation P-Number 4 add the following:

Material Spec.	Psi Min. Tensile	Type of Material
SA-423	60,000	Cu-Cr-Ni Tubes (0.40 Cu-0.24–1.31 Cr-0.45 Ni)

MATERIALS AND STRESS VALUES TO BE ADDED AND REVISIONS TO BE MADE TO TABLE UCS-23

Material and Specification Number	Grade	Nominal Composition	P Number	Spec Min Tensile	Notes	For Metal Temperatures Not Exceeding Deg F —20 to 650	700	750	800	850	900	950	1000	1050	1100	1150	1200
PLATE STEELS																	
Low-Alloy Steels																	
SA-353	A	9Ni	10	90000	(17)	22500	—	—	—	—	—	—	—	—	—	—	—
SA-353	B	9Ni	10	95000	(17)	23750	—	—	—	—	—	—	—	—	—	—	—
PIPES & TUBES																	
Seamless Low-Alloy Steels																	
SA-213	T3$_b$				Delete this Grade												
SA-213	T2	$^1/_2$Cr-$^1/_2$Mo	3	60000	—	15000	15000	15000	14400	13750	12500	10000	6250	—	—	—	—
SA-423	—	$^3/_4$Cr-$^1/_2$Ni-0.4Cu		60000	—	15000	—	—	—	—	—	—	—	—	—	—	—
FORGINGS																	
Low-Alloy Steels																	
SA-182	F21	3Cr-0.9Mo	5	70000	(14)	—	15100	14600	13900	13200	12000	9000	7000	5500	4000	2700	1500

Add To Note (14) of Table UCS-23

Spec.	Grade	For Metal Temperatures Not Exceeding Deg F — 20 to 400	500	600	650
SA-182	F21	17500	16800	16000	15600

ADD TO TABLE UCS-27

Specification Number	Grade	Nominal Composition	Weld	Spec Min. Tensile	Notes	—20 to 650
SA-243	—	$^3/_4$Cr-$^1/_2$Ni-0.4Cu	Elect.	60000	—	12750

MATERIALS AND STRESS VALUES TO BE ADDED AND REVISIONS TO BE MADE TO TABLE UHA-23

Material and Specification Number	Grade	Type	Nominal Composition	Spec Min Tensile	Notes	For Metal Temperatures Not Exceeding Deg F — 20 to 100	200	300	400	500	600	650	700
PIPES & TUBES													
Seamless													
SA-213	TP321	—	18Cr-10Ni-Ti	75000	(10)	No change in stress values thru 1000 F. Delete all stress values for							
SA-213	TP321H	—	18Cr-10Ni-Ti	75000	(10)	18750	18750	17000	15800	15200	14900	14850	14800
FORGINGS													
SA-182	F304L	304L	18Cr-8Ni	65000	(1)	16250	15850	15400	15000	14000	13000	12500	12000
SA-182	F304L	304L	18Cr-8Ni	65000	—	16250	14550	12850	11000	9700	9000	8750	8500
SA-182	F316L	316L	17Cr-12Ni-2Mo	65000	(1)	16250	15750	15250	14750	14000	13600	13450	13250
SA-182	F316L	316L	17Cr-12Ni-2Mo	65000	—	16250	14850	13450	12000	11000	10150	9800	9450
	Replace the present stress values for Grade F310 with the following:												
SA-182	F310	310	25Cr-20Ni	75000	(2)(10)	18750	18750	18500	18200	17700	17200	16900	16600
SA-182	F310	310	25Cr-20Ni	75000	(3)(10)	18750	18750	18500	18200	17700	17200	16900	16600
CASTINGS													
SA-351	CH8	—	25Cr-13Ni	65000	(6)(10)	16250	15700	15150	14600	14550	14450	14400	14350
BOLTING													
	Revise the last line to read as follows:												
SA-320	(10 Grades)		—	—	(5)(7)(8)	—	—	—	—	—	—	—	—

MATERIALS AND STRESS VALUES TO BE ADDED AND REVISIONS TO BE MADE TO TABLE UHA-23 (cont.)

For Metal Temperatures Not Exceeding Deg F 750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	Material and Specification Number	Grade or Type
temperatures above 1000 F			—	—	—	—	—	—	—	—	—	—	—	—	—	SA-213	TP321
14700	14550	14300	14100	13850	13500	13100	12500	8000	5000	3600	2700	2000	1550	1200	1000	SA-213	TP321H
11500	11000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SA-182	F304L
8300	8100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SA-182	F304L
13000	12700	12250	—	—	—	—	—	—	—	—	—	—	—	—	—	SA-182	F316L
9100	8800	8500	—	—	—	—	—	—	—	—	—	—	—	—	—	SA-182	F316L
16250	15700	14900	13800	12500	11000	9750	8500	7250	6000	4750	3500	2350	1600	1100	750	SA-182	F310
16250	15700	14900	13800	12500	11000	7100	5000	3600	2500	1450	750	450	350	250	200	SA-182	F310
14300	14150	13900	13500	12500	10500	8500	6500	5000	3800	2900	2300	1750	1300	900	750	SA-351	CH8
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SA-230	(10 Grades)

Current Engineering Events, News, and Comment

E. S. NEWMAN
News Editor

THE ROUNDUP

International Rubber Conference Covers Full Range of Rubber Technology

Complete Proceedings available from ACS

The introduction to the International Rubber Conference, Washington, D. C., Nov. 8–13, 1959, sponsored by the Division of Rubber Chemistry of the American Chemical Society, the Committee on Rubber and Rubberlike Materials of the American Society for Testing Materials, and the Rubber and Plastics Division of The American Society of Mechanical Engineers, was given by Wallace R. Brode, Science Adviser to the Secretary of State.

Speaking on the "International Implications of the Development of Science and Technology," he stated: "It is a well-established phenomenon that our scientific progress is not a single linear function but is expanding at an exponential rate. Each year we publish about ten per cent more scientific material than in the preceding year and our total production doubles about every eight years."

Dr. Brode spoke of the attempts to give some co-ordinated planning to government research—the President's Science Advisory Committee, the Federal Council for Science and Technology. He also mentioned the proposal to establish a Department of Science and Engineering. Great Britain already has announced the creation of such a department, and France and Belgium have ministerial or cabinet advisory posts. Similar moves are taking place in other countries.

The conference considered the full range of rubber technology, production, and chemistry, represented by the sponsoring societies. Of particular interest to mechanical engineers were sessions on equipment and processes in rubber manufacturing. A group of sessions on tires had considerable material on testing, mechanical behavior, stresses, rubber abrasion, and the role of hysteresis in tire wear. A session on theory considered viscosity and relaxation measurements, and flow and slip-velocity measurements among other subjects. Other session topics included polymers and polymer structure, and vulcanization.

The 616-page Proceedings of the conference, containing preprints of all 73 papers presented, is available from The American Society of Mechanical Engineers, Order Department, 29 West 39th Street, New York 18, N. Y., at $12.50 a copy to nonmembers; $10 to members of the sponsoring societies.

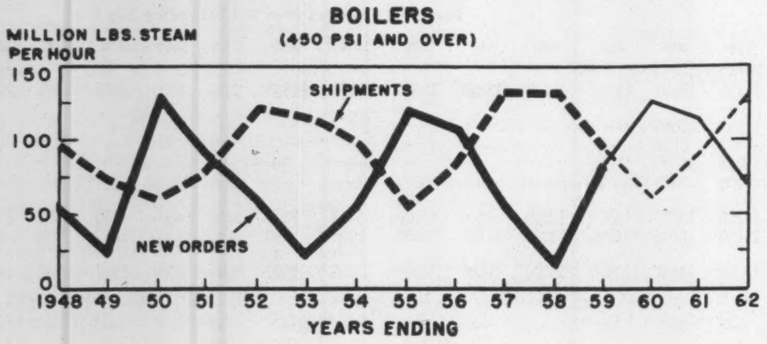
Power Boiler Industry—Outlook for 1960

The power boiler industry was expected to produce and ship, in 1959, units capable of generating 95 million pounds of steam per hour for power-generation and process uses, or 27 per cent less than in 1958 and approximately 30 per cent less than for its record year 1957, the Business and Defense Services Administration, U. S. Department of Commerce, reported recently. Shipments of power boilers (heating boilers are not included) in 1959 were about equal to the average shipments over the last ten years. Shipments scheduled for 1960 on orders placed in 1959 and earlier are approximately 35 per cent lower than the 1959 deliveries for domestic electric power systems, industrial plants, and exports.

The utilities who cut back further on their expansion plans during 1958's recession reversed in 1959 the downward movement of new orders which began in 1956. New orders during 1959 were four to five times greater than 1958, but only 21 per cent higher than the average over the previous ten years.

This vividly depicts how depressed 1958 was for power-boiler manufacturers with respect to new orders. Due to the long manufacturing lead time for power boilers (12 to 18 months for fabrication, another 14 to 18 months for field erection) the effect of the 1958 decline in orders will be materially felt in 1960.

The cyclical effect in new orders and shipments that has characterized the industry over the years is illustrated in the chart and indicates that 1960 will



be one of the best years for new orders but one of the lowest years for shipments. New orders for 1960 are expected to increase approximately 50 per cent over 1959.

New power-plant construction in the last several years has created a total capacity which results in a reserve of approximately 25 per cent over the December peak-load requirements.

Shipments of power boilers in 1960 are expected to drop under 70-million-lb-of-steam-per-hr capacity for the first time since 1955, the last industry low in the cyclical pattern. This will reflect the low volume of orders received in 1958.

Because these units require such a long manufacturing lead time and the major portion of steel required to meet specific design conditions is ordered early in the production cycle, it is difficult to ascertain the exact effects of the steel strike of 1959. Production delays caused by the strike may drop expected 1960 shipments below the forecast and subsequently raise the 1961 shipments above those presently anticipated.

EDUCATION

Caltech New Building

Ground was broken recently for the $2,500,000 W. M. Keck Engineering Laboratories of the California Institute of Technology.

The five-story structure is a gift of the W. M. Keck Foundation and is the largest gift in Caltech's current development campaign.

W. M. Keck, founder and chairman of the board, Superior Oil Company, touched off the ground-breaking.

Solid and fluid mechanics will be taught, and advanced research in these fields and in the field of sanitary engineering will be carried on in the new structure.

Writing for Engineers

Case Institute of Technology will institute an "across the board" effort to improve the writing ability of its undergraduates during the coming school year, Karl B. McEachron, Jr., Mem. ASME, Dean of Instruction, announced recently.

In addition to required undergraduate courses in composition, a special staff of readers will be available to supervise and evaluate student writing throughout the four-year undergraduate program. This includes writing done in engineering and scientific courses, as well as in the humanities and social studies.

Commenting on the new program Dean McEachron said, "If a student is to develop and maintain skill in written communication, he must recognize its importance in everything he writes, whether in a class in composition or in a final examination in a highly technical subject." The new service, the Dean emphasized, stems from the great concern of the faculty that students recognize the importance of effective writing and be provided the necessary guidance to develop their skills in this area.

LITERATURE

ASME Publications

The American Society of Mechanical Engineers issues annually a large number of publications. Many of these are the products of efforts of the Society's Boards and Committees working independently or in conjunction with other societies. Often these publications are available at a 20 per cent discount to ASME members.

A list of the most recent of these publications obtainable from the ASME Order Department, 29 West 39th Street, New York 18, N. Y., follows:

- **"American Standard Safety Code for Powered Industrial Trucks,"** ASA B56.1, 1959, $1.50.
- **"American Standard Safety Code for Elevators, Dumbwaiters, and Escalators,"** A17.1–1955 and supplement A17.1a–1957, $3.50, sponsored by National Bureau of Standards, The American Institute of Architects, and ASME.
- **"Graphical Symbols for Welding,"** ASA Y32.3–1959, $3, collaborator American Welding Society; sponsors, AIEE and ASME.
- **"High Speed Steel and Cast Nonferrous Single Point Tools and Tool Holders,"** ASA B5.29–1959, $1, sponsors, ASTE, SAE, National Machine Tools Builders' Association, Metal Cutting Tool Institute, and ASME.
- **"Rotating Air Cylinders and Adapters,"** ASA B5.5–1959, $1, sponsors, Metal Cutting Tool Institute, SAE, National Machine Tool Builders' Association, ASTE, and ASME.
- **"Trial American Standard Class 5 Interference-Fit Thread,** ASA B1.12, $1, sponsors, SAE and ASME.

International Conference

All engineers whose specialty is automatic control will be interested in the 1960 meeting in Moscow, USSR, scheduled by the International Federation of Automatic Control. Since its organization in 1958, the Federation has directed its efforts primarily toward its first congress—in Moscow, scheduled for June 27 to July 3, 1960.

Reporting for the USSR National Committee of Automatic Control, host for the conference, Dr. A. M. Letov (USSR Institute of Automatics and Telemechanics), has advised that 321 authors who had submitted abstracts have been invited to complete their papers for final selection. The Soviet hosts expect to pick about two thirds of that number for presentation.

The tentative program allows six days for the presentation of papers, and three full days for prearranged visits to plants and technical institutes. The program will be divided into three sections covering the fields of theory, components, and application.

Intourist, the Soviet tourist agency, will handle all travel and accommodations within the USSR. Registrants may select any of several Intourist rates, ranging from $30 a day, down to $10 a day. For information, write to William E. Vannah, Secretary, American Automatic Control Council (Editor, *Control Engineering*), 330 West 42nd Street, New York 36, N. Y. Registration paid in advance of March 31, 1960, will entitle you to a full set of preprints in English.

The ASME is an affiliate of the American Automatic Control Council.

More Creativity

"How to Increase Your Creative Output—A Guide for the Engineer and Scientist," has been prepared to provide a series of practical guideposts for increasing creative output. Mastery of these guideposts and procedures will help in avoiding traps and time-consuming trial-and-error in the solution of problems. The 22-page booklet costs $1.50, and is prepared by Deutsch & Shea, Inc., 230 West 41st Street, New York, N. Y.

RESEARCH

Plasma Physics

The National Bureau of Standards under the sponsorship of the Air Research and Development Command, has initiated a theoretical research study aimed at solving basic problems in plasma physics. This work, by C. M. Tchen of the mathematical physics group, forms a part of a comprehensive Bureau-wide program to provide basic data and theory for plasma physics and astrophysics. As plasma is a unique state of matter with properties depending strongly on its dynamical configuration, the present project will emphasize dynamical aspects. That is, it will concentrate on the flow of an ionized gas through magnetic and electric fields.

Recently, the field of theoretical plasma dynamics and magnetohydrodynamics (MHD) has grown rapidly, creating a wide variety of research problems. Moreover, the recent developments of space technology and cosmic flight have focused attention on the dynamic behavior of cosmic gases, their interaction with magnetic fields, and the motion of bodies—stars, planets, and artificial satellites—in a cosmic medium. Because of the increasing importance of the field and the present lack of basic data, the Bureau has undertaken the present research program.

Basic Research and the Navy

A study of "Basic Research in the Navy" has been sponsored by the Naval Research Advisory Committee and prepared by Arthur D. Little, Inc., under a contract with the Office of Naval Research. The two-volume study applies new methods for measuring the amount of basic research that is done, illustrates the mission orientation of basic research in the Navy, and depicts the anatomy of basic research. Of interest are the various case histories of the shock wave, radar, the transistor, and their relation to basic research in the Navy. The Office Services, Department of Commerce, is handling distribution of the report.

Feet Hurt?

How great is the load on your feet? Science for the first time is trying to measure this load in research conducted at Case Institute of Technology. The answers found will be important to surgeons in demonstrating how much of a load is placed upon broken bones in the leg. Findings will also be used by the designers of mechanical bone and joint replacements and will allow these designers to make better calculations of the factors of safety involved.

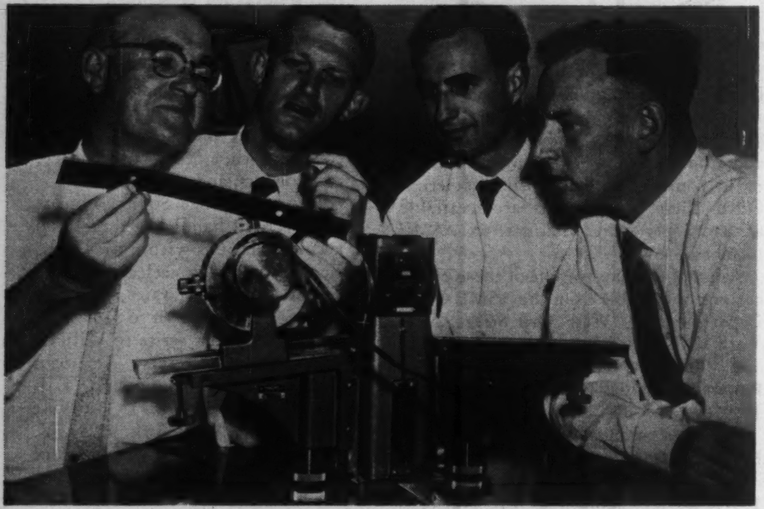
Measurements of the load on the feet are also important to designers and manufacturers of shoes.

In the experiments, not only the vertical load on the foot as an individual walks will be measured, but also the twisting forces, sideways and forward, that are involved in each step will be calculated. Such factors as high-heeled shoes and running and jumping will also be studied, as well as the way a person's gait changes as he grows older.

Iowa State

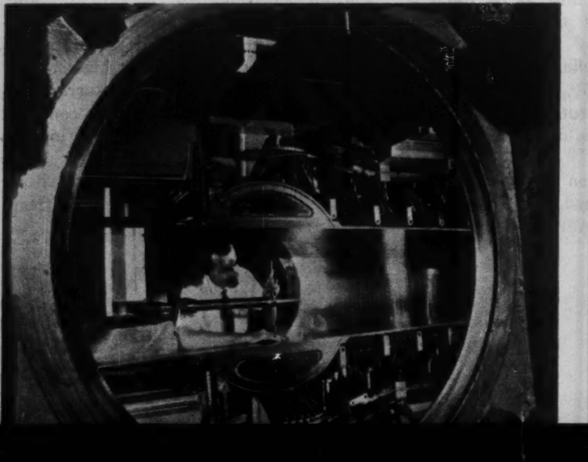
Cyclone, a high-speed digital computer has been constructed by university personnel and is now in operation at Iowa State University at Ames. The machine is modeled on ILLIAC, the computer constructed by the University of Illinois. Michigan State University and the University of Sydney, Australia, have also completed machines modeled on ILLIAC, and the four institutions are sharing program libraries.

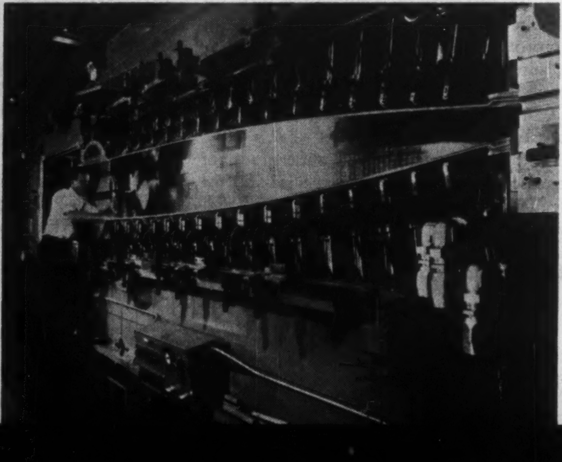
The university also now has in operation a 10-kw, water-moderated, graphite-reflected reactor.



The four principal scientists who have perfected successfully a method of manufacturing synthetic diamond material examine an x-ray negative proving the authenticity of their achievement, at the Adamant Laboratory of De Beers Consolidated Mines in Johannesburg, South Africa. The scientists are, **left to right:** J. F. H. Custers, director of research, B. W. Senior, P. T. Wedephol, and H. B. Dyer. The x-ray negative proves, by comparison with a similar x-ray negative of natural diamond, that the product is in fact diamond.

Downstream view of the nozzle of the California Institute of Technology Jet Propulsion Laboratory (JPL) new $3½-million hypersonic wind tunnel, **left,** shows a JPL technician checking the position of the calibration probe used to measure the aerodynamic characteristics of the new tunnel. JPL is a research facility of the NASA. The two tapering stainless-steel plates, which can be seen at the top and bottom of the nozzle, are flexible and can be contoured to test forms by system of 16 hydraulic jacks. A model of the U. S. Army's Sergeant missile is checked, **right,** before testing in new tunnel. Tunnel has a 21-in. × 21-in. test section and can generate air speeds nine times the speed of sound.





PEOPLE

B. G. Elliott, Fellow ASME, **second from right,** holds award presented to him by the ASME Rock River Valley Section. Occasion for the award was the joint meeting of the ASME student section, University of Wisconsin, and the Rock River Valley Section to celebrate the fiftieth anniversary of the founding of the ASME Wisconsin Student Section. Professor Emeritus Elliott who is the former head of the department of mechanical engineering at Wisconsin is shown with, **left to right,** A. G. Christie, past-president and Hon. Mem. ASME and a member of the faculty at Wisconsin at the time of the founding of the Student Section; C. F. Hurc, Assoc. Mem. ASME; and K. F. Wendt, dean of the engineering school, University of Wisconsin.

Honors and Awards. Glenn T. Seaborg, nuclear scientist and chancellor of the University of California, has been named the recipient of the Enrico Fermi Award for 1959. A medal and citation go with the $50,000 AEC award presented to Dr. Seaborg "for discoveries of plutonium and several additional elements and for leadership in the development of nuclear chemistry and atomic energy."

Charles S. Draper, Fellow ASME, received the Magellanic Premium, a gold-medal award established by the American Philosophical Society in 1786. Dr. Draper, head of the department of aeronautics and astronautics at the Massachusetts Institute of Technology, was honored for his pioneer work in modern inertial navigation.

W. H. McAdams, Mem. ASME, and Francis J. Curtis, St. Louis, Mo., were named recipients of the American Institute of Chemical Engineers 1959 Founders Awards. The award is given in recognition of outstanding contributions in the field of chemical engineering. The awards were presented at the AIChE Annual Meeting in San Francisco, Calif., Dec. 6–9.

W. R. Marshall, Jr., professor of chemical engineering and associate dean of the University of Wisconsin College of Engineering and associate director of Wisconsin's Engineering Experiment Station, received the 1959 Professional Progress Award of the AIChE. The $1000 award and certificate, sponsored by the Celanese Corporation of America and presented by the Awards Committee and Council of the AIChE, is given annually to a chemical engineer in recognition of his "outstanding progress in the field of chemical engineering."

The award was presented to Dr. Marshall Tuesday night, Dec. 8, at the Awards Dinner held during the annual meeting of the national organization in San Francisco, Calif., Sunday through Wednesday, Dec. 6–9.

Under terms of the award, the recipient must be less than 45 years of age and must have made a significant contribution to the science of chemical engineering, such as a theoretical discovery or development of a new principle in the field, a development of a new process or product, an invention or development of new equipment, or distinguished service rendered to the field or profession of chemical engineering.

Professor Marshall also gave one of the main addresses at the general session of the institute's meeting at 11 a.m. Tuesday. The title of Marshall's address was: "Engineering—A Unifying Force."

T. Keith Glennan, administrator of the National Aeronautics and Space Administration and President-on-leave of Case Institute of Technology, Cleveland, Ohio, delivered the first annual Tau Beta Pi lecture at the American Association for the Advancement of Science meeting in Chicago, Ill., in December, 1959. Dr. Glennan's subject was "A New Order of Technological Challenge in the Nation's Space Program."

A new award established by the Society of Naval Architects and Marine Engineers for distinguished achievement in ship research was presented posthumously on November 14, to the man whose name it honors, the late Kenneth S. M. Davidson, Mem. ASME, founder of the Davidson Laboratory at Stevens Institute of Technology.

B. W. Berenschot of The Netherlands is the recipient of the Wallace Clark Award for 1960. Professor Berenschot's initiative in organizing the International University Contact and his developments of improved management practices have importantly raised the quality of management performance in many countries throughout the world.

Charles M. White, chairman of the board and chief executive officer, Republic Steel Corporation, has been named the recipient of the Benjamin F. Fairless Award of the American Institute of Mining, Metallurgical, and Petroleum Engineers. To be presented to Mr. White at the Annual Meeting of AIME, in New York City, February 14–18, 1960, the Award is in recognition of the fact that "his ability, energy, and determination in starting the top-pressure blast furnace and foresight in providing it with prepared burdens have created the world's dominant metal producer."

Robert J. Linney, executive vice-president and member of the executive committee of Reserve Mining Company, Silver Bay, Minn., will also be honored by AIME. He has been named the recipient of the William Lawrence Saunders Gold Medal. The award recognizes distinguished achievement in mining other than coal.

New Officers. Ronald L. McFarlan, consultant to the DATAmatic Corporation and the Raytheon Manufacturing Company, has been elected president for

1960 of the Institute of Radio Engineers. Dr. McFarlan succeeds Ernst Weber, president of the Polytechnic Institute of Brooklyn, as head of the society scientists.

Jerry McAfee, vice-president, manufacturing department, Gulf Oil Company, Pittsburgh, Pa., has been elected 1960 president of the AIChE.

Jacob R. Sensibar, president, Construction Aggregates Corporation, Chicago, Ill. has been elected national president of the American Technion Society.

New Appointments. Edward Wenk, Jr., Mem. ASME, has accepted an appointment as senior specialist in science and technology, Legislative Reference Service, Library of Congress. The Service undertakes comprehensive analytical studies and prepares interpretive reports for Members and Committees of the United States Congress on a nonpartisan basis. Previously staffed in such areas as foreign affairs, law, taxation, natural resources, and public welfare, Dr. Wenk's appointment represents an extension of activities to deal with assignments on policy matters in the field of science and technology.

The National Science Foundation announced the appointments of Richard H. Bolt as Associate Director (Research) and Harry C. Kelly as Associate Director (Scientific Education).

Died. Walter Joseph Murphy, editorial director of the American Chemical Society's Applied Journals, died Nov. 26, 1959, in Washington, D. C. Under his leadership during the past 17 years, the ACS applied publications became the largest scientific publication program in the world, with a total circulation of over 165,000.

INDUSTRIAL FILMS

Asbestos

A new 16-mm sound-and-color educational motion picture film, "Asbestos. . . A Matter of Time," covering the geological formation, modern production methods, and the varied uses for this unusual mineral fiber, is available. At an open-pit mine in Canada, the film follows modern surface-mining operations—drilling, blasting, and removing the asbestos-bearing ore from the earth. The film shows the underground block-caving method of extracting the mineral, revealing how large segments of the ore are prepared before drilling, blasting, and caving. The ore is shown being processed in a mill where the impurities are removed in modern equipment and the asbestos fibers emerge.

The 20-minute film may be obtained for free load by organizations by writing to Graphic Services, Bureau of Mines, U. S. Department of the Interior, 4800 Forbes Avenue, Pittsburgh 13, Pa. Production of the film was sponsored by the Johns-Manville Sales Corp.

Rail Welding

"Clear Board for Ribbonrail" has just been released by the Oxweld Railroad Department of Linde Company, Division of Union Carbide Corporation. Photographed entirely on location at railroad sites, the film tells the complete story of Linde's "Ribbonrail" Service to railroads during the installation of continuous welded rail. It shows the step-by-step process of welding, transporting, and laying continuous welded rail.

The 24-minute, 16-mm., color-sound film will be loaned free of charge to any railroad personnel requesting it. Write W. J. Corriveau, Oxweld Railroad Department, Linde Company, 230 N. Michigan Avenue, Chicago 1, Ill. As the demand for the film has been great, please also specify an alternate date.

COMING MEETINGS

Man and His World

The University of California School of Medicine and University of California Extension will present a three-day conference on "Man and His Environment: The Air He Breathes," Jan. 16–18, 1960, in San Francisco, Calif.

According to University officials, "The Conference will emphasize a multidisciplinary approach to the problems of man in his environment. The meeting is designed for physicians, physiologists, pathologists, ecologists, town planners, engineers, and others. The problems will be considered from the widest biologic point of view."

Topics for consideration will include: "The 'Normal' Atmosphere and Its Variation"; "The Air-Pollution Problem of Industry"; "Urban Living and Air Pollution"; and such specific problems as "Airborne Factors in Cancer."

Plant Maintenance & Engineering

Seventy-one speakers will address the eleventh Plant Maintenance and Engineering Conference at Convention Hall, in Philadelphia, Pa., Jan. 25–27. The conference, one of the best attended engineering meetings of the year, is held annually in conjunction with the Plant Maintenance and Engineering Show. The 1960 Show will be held Jan. 25–28. Both events are produced by Clapp & Poliak, Inc., New York City exposition management firm.

L. C. Morrow, Fellow ASME consulting editor, *Factory*, will serve as general chairman of the conference. Speakers, who will lead 43 discussion sessions, are drawn from 52 companies, in 20 basic industries, located in 19 states and three Canadian provinces.

Engineers' Week

Annually, since 1951, the National Society of Professional Engineers has been promoting a National Engineers' Week. Traditionally, this is the week of George Washington's birthday for a twofold purpose: To commemorate the engineering and building achievements of the first president of the United States and the many contributions made by engineers to the American way of life.

The theme for the 1960 Engineers' Week is "Engineering's Great Challenge—the 1960's." Leading engineering figures from industry, education, private practice, government service, and the military will act as sponsors of this year's event.

MEETINGS OF OTHER SOCIETIES

Jan. 25–28

Institute of the Aeronautical Sciences, annual meeting, Hotel Astor, New York, N. Y.

Jan. 25–28

Plant Maintenance and Engineering Show, Convention Hall, Philadelphia, Pa.

Jan. 31–Feb. 5

AIEE, winter general meeting, Hotel Statler Hilton, New York, N. Y.

Feb. 1–4

ASHRAE, semi-annual meeting and second southwest heating and air-conditioning exposition, Baker Hotel and Memorial Auditorium, Dallas, Texas.

Feb. 1–5

ISA, Instrument-Automation Conference and Exhibit, Rice Hotel and Sam Houston Coliseum, Houston, Texas.

Feb. 14–18

AIME, annual meeting, Statler Hilton and McAlpin Hotels, New York, N. Y.

(For ASME Coming Events, see page 129)

Notes on
Society Activities
and Events

E. S. NEWMAN
News Editor

THE ASME NEWS

Joint Symposiums on Compressor Stall, Surge, and System Response to Highlight ASME Gas Turbine Power and Hydraulic Conference and Exhibit

THE 1960 ASME Gas Turbine Power and Hydraulic Divisions Conference and Exhibit scheduled for March 6–9, at the Rice Hotel in Houston, Texas, will feature Joint Symposiums on Compressor Stall, Surge, and System Reponse as a high light of the technical program.

The symposiums will supplement the technical program consisting of one joint session on compressor performance, seven Gas Turbine Power Division sessions, and eight Hydraulic Division sessions which will deal with the operation, maintenance, and economics of gas turbines in industry and prime movers, water hammer, fluid mechanics, and cavitation phases of the hydraulic areas of operation in industry.

Added features to the interesting program will be an exhibit displaying the products of many gas-turbine manufacturers and accessory manufacturers, inspection trips to nearby gas-turbine installations, to be announced at a later date, and the Gas Turbine Power Division Luncheon on Wednesday, March 9, with Walker L. Cisler, ASME President, as guest speaker.

The tentative program is as follows:

▶SUNDAY, MARCH 6

Exhibit Setup Commences 8:00 a.m.
Committee Meetings 2:30 p.m.
Advance Registration 3:00–6:00 p.m.
Committee Meetings 7:30 p.m.

▶MONDAY, MARCH 7

Registration 8:00 a.m.
Exhibits Open 8:30 a.m.
Gas Turbine Power Division—Session 1 9:00 a.m.

Operation and Maintenance of Remotely Controlled Gas-Turbine Units,[1] by *R. C. Hill*, Trans-Arabian Pipeline Co., Beirut, Lebanon

Comparison of Operating Characteristics of a Dual-Shaft Gas Turbine With a Single-Shaft Gas Turbine for Gas-Line Pumping,[1] by *M. J. McDonough*, Westinghouse Electric Corp., Philadelphia, Pa.

Operating Experience on Nimonic 80A First-Stage Turbine Buckets on Natural Gas,[1] by *A. W. Herbenar* and *G. R. Heckman*, General Electric Co., Schenectady, N. Y.

Joint Session—1 9:00 a.m.

Symposium on Compressor Stall, Surge, and System Response—1

General Lecture on Compressor Stall, Surge, and System Response,[1] by *H. W. Emmons*, Harvard Univ.

Instability and Surge in Dual-Entry Centrifugal Compressors,[1] by *J. L. Dussourd*, AiResearch Mfg. Co. of Arizona, Phoenix, Ariz.

Use of Experimentally Determined Acoustic Impedance in Analysis of Propulsion-System Stability,[1] by *C. L. Dailey* and *A. C. Brown*, Wiancko Engineering Co., Pasadena, Calif.

Sonic Control of Dynamic Compressor Instability,[1] by *A. G. Bodine*, Soundrive Engine Co., Los Angeles, Calif.

Hydraulic Division—Session 1 9:00 a.m.

Prime Movers—1

Experiences With Hydraulic Prime Mover Controls,[1] by *F. R. Schleif*, U. S. Bureau of Reclamation, Denver, Colo.

Reduction of Turbine Runner Vibrations Experience in Southwestern Division, Corps of Engineers, by *F. C. Taylor*, Corps of Engineers, Dallas, Texas (Paper No. 60—HYD-4)

Cocktails in Exhibit Hall 11:30 a.m.–12:30 p.m.

Welcoming Luncheon 12:30 p.m.–2:30 p.m.

Gas Turbine Power Division—Session 2 2:30 p.m.

250-Kw Marine Gas Turbine of the Thompson-Ramo-Wooldridge,[1] by *M. L. Frasier*, Thompson-Ramo-Wooldridge, Inc., Cleveland, Ohio

Report on 9000-Hr Operation of Marine Propulsion Gas Turbine in the John Sergeant,[1] by *C. C. Tangerini*, U. S. Maritime Administration, Washington, D. C., *W. H. Van Cott*, United States Lines, and *H. D. McLean*, General Electric Co., Schenectady, N. Y.

1100-HP Gas Turbine for Marine Application,[1] by *P. A. Pitt*, Solar Aircraft Co., San Diego, Calif., and *R. G. Mills*, Bureau of Ships, Washington, D. C.

Joint Session—2 2:30 p.m.

Symposium on Compressor Stall, Surge, and System Response—2

Control Systems for Stall Prevention,[1] by *S. Drabek*, General Electric Co., Cincinnati, Ohio

Parallel Operation of Turbomachines in Gas-Cooled Reactor Systems,[1] by *W. T. Furgerson*, General Atomic Corp., San Diego, Calif.

The Surge Problem in Relation to the ASME Compressor Test Code,[1] by *J. T. Hamrick*, Thompson-Ramo-Wooldridge, Inc., Cleveland, Ohio

The Effect of Secondary Vorticity in Vaneless Diffusers on Surge Characteristics of Centrifugal Compressors,[1] by *G. O. Ellis*, Carrier Corp., Syracuse, N. Y.

Hydraulic Division—Session 2 2:30 p.m.

Prime Movers—2

Selection of the Hydraulic Turbines for the Mammoth Pool Project of the Southern Califor-

ASME Papers By Mail

Only *numbered* papers in this program are available in separate copy form until Jan. 1, 1961. Copies may be obtained from the ASME Order Department, 29 West 39th Street, New York 18, N. Y. Prices are 40 cents each to members of ASME; 80 cents each to nonmembers. Papers must be ordered by the paper numbers listed in this program, otherwise the order will be returned. The final listing of technical papers will be found in the issue of MECHANICAL ENGINEERING containing an account of the Conference.

Note: Papers in Joint Symposiums 1, 2, and 3 on Compressor Stall, Surge, and System Reponse will be available at the Conference in one complete bound publication volume and not as individual preprints, and will be sold at a price to be announced at the Conference.

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[1] Paper not available—see box on this page.

nia Edison Company,[1] by *H. E. Burrier*, Southern California Edison Co., Los Angeles, Calif.

The Application of Internal-Gear Rotary Pumps to Viscous Liquid Service, by *S. L. Fry* and *L. H. Kessler*, Fairbanks Morse & Co., *R. J. Kinnavy*, The Deming Co., Salem, Ohio, and *S. E. Kots*, Fairbanks Morse & Co., Kansas City, Kan. (Paper No. 60—HYD-1)

Exhibits Close 6:30 p.m.

Gas Turbine Power Division—Session 3 7:30 p.m.

Development Experience With Prototype Gas Turbines,[1] by *J. E. Cook*, Standard Vacuum Oil Co., White Plains, N. Y.

Economic Applications of the Small Gas Turbine, by *J. R. Kettler*, AiResearch Industrial Div., Los Angeles, Calif.

Joint Session—3 8:00 p.m.

Symposium on Compressor Stall, Surge, and System Response—3

A Simple Steady-State Map Generation Technique,[1] by *G. L. Mellor*, Princeton Univ.

The Effect of Tip Clearance on Compressor-Pressure Rise,[1] by *R. E. McNair*, Westinghouse Electric Corp., Philadelphia, Pa.

Some Theoretical Aspects of Blade Vibration Due to Stall Excitation,[1] by *F. W. Parry*, Solar Aircraft Co., San Diego, Calif.

▶TUESDAY, MARCH 8

Registration 8:00 a.m.

Exhibits Open 8:30 a.m.

Gas Turbine Power—Session 4 9:00 a.m.

Gas-Steam Power Generation,[1] by *P. T. Martinuzzi*, Stevens Inst. of Tech., Hoboken, N. J.

Economics of the Combined Steam-Gas Turbine Exhaust Heat Cycle for Medium-Sized Electric Utilities[1] by *W. M. Sybert*, Kaiser Engineers, Oakland, Calif.

Heat Recovery From Gas-Turbine Exhaust[1] by *G. L. Morris*, Brown and Root, Inc., Houston, Texas

Hydraulic Division—Session 3 9:00 a.m.

Water Hammer

Pressure Surges in Pipeline Carrying Viscous Liquids, by *W. T. Rouleau*, Carnegie Inst. of Tech., Pittsburgh, Pa. (Paper No. 60—HYD-5)

Pressure Oscillations in a Water-Cooled Nuclear Reactor Induced by Water-Hammer Waves, by *P. Lieberman* and *E. A. Brown*, Illinois Inst. of Tech., Chicago, Ill. (Paper No. 60—HYD-2)

Analog Solution of a Transient Hydraulic Problem in the Power Industry,[1] by *B. H. Taylor*, Univ. of California, Los Angeles; *A. Reisman*, Los Angeles State College, Los Angeles, Calif.; *B. DeLand* and *J. Ward*, Rand Corp, Santa Monica, Calif.; and *H. Baudistel*, Department of Water and Power, City of Los Angeles, Los Angeles, Calif.

Hydraulic Division—Session 4 9:00 a.m.

Fluid Mechanics—1

Two-Dimensional Flow With Standing Vortices in Ducts and Diffusers,[1] by *F. O. Ringleb*, Naval Material Center, Philadelphia, Pa.

The Coring Phenomenon in the Flow of Suspension in Vertical Tubes,[1] by *D. F. Young*, Iowa State College, Ames, Iowa

Accelerations and Mean Trajectories in Turbulent Channel Flow, by *Shaggra Irmay*, Israel Inst. of Tech., Haifa, Israel (Paper No. 60—HYD-3)

Cocktails in Exhibit Hall 11:30–12:30 p.m.

Gas Turbine Power Division—Session 5 2:30 p.m.

Operating Experience With a 15-Mw Blast-Furnace-Fired Gas Turbine in a German Steel Mill,[1] by *F. K. Koenig*, Huettenwerk Rheinhausen, Rheinhausen, Germany

Three Years' Operating Experience With 7500 Kw Gas-Turbine Plants in Belgian Steelworks,[1] by *E. Aguet* and *J. de Salis*, Sulzer Brothers, Ltd., Winterthur, Switzerland

Application of Gas Turbines in Industry,[1] by *C. R. Apitz*, Clark Brothers Co., Dallas, Texas

Hydraulic Division—Session 5 2:30 p.m.

Cavitation Symposium—1

Flow Abnormalities and NPSH,[1] by *R. M. Watson*, Syracuse Univ.

The Practical Application of NPSH Correction,[1] by *H. A. Stahl* and *A. J. Stepanoff*, Ingersoll Rand Corp., Phillipsburg, N. J.

Effect of Speed on Hot Water NPSH,[1] by *Victor Salemann*, Worthington Corp., Harrison, N. J.

Actual NPSH Requirements of Centrifugal Pumps Compared to NPSH Requirements as Determined by Laboratory Tests,[1] by *E. E. Lindros*, Byron-Jackson Division—Borg-Warner Corp., Los Angeles, Calif.

Effect of Varying Available NPSH on the Head Capacity Curve of High Specific Speed Pumps,[1] by *D. R. Rankin*, Peerless Pump Division, Food Machinery and Chemical Corp., Los Angeles, Calif.

The Effects of Air on the Determination of Critical NPSH,[1] by *W. W. Waltmer*, Allis-Chalmers Mfg Co., Milwaukee, Wis.

A Chemical Engineer's Attempt to Explain NPSH Corrections as Applied to Butane,[1] by *A. M. Whistler*, Fluor Corporation Ltd., Los Angeles, Calif.

Hydraulic Division—Session 6 2:30 p.m.

Fluid Meters—2

Supersonic Diffuser for Radial and Mixed-Flow Compressors,[1] by *F. Dallenbach*, AiResearch Corp. Phoenix, Ariz., and *N. Van Le*, Garrett Corp., Los Angeles, Calif.

A Jet-Pump Design Theory, by *T. W. Van der Lingen*, National Mechanical Engineering Research Inst., Pretoria, South Africa (Paper No. 60—HYD-6)

Cocktails 6:00 p.m.

Banquet of Hydraulic Division 7:00 p.m.

Toastmaster: *H. Emmons*, Harvard Univ.
Speaker: *W. V. Houston*, Rice Inst.

▶WEDNESDAY, MARCH 9

Registration 8:00 a.m.

Exhibits Open 8:30 a.m.

Gas Turbine Power Division—Session 6 9:00 a.m.

Experience With Gas Turbines in French Power Stations,[1] by *P. Chambadel*, Électricité de France, Paris, France

Gas-Turbine Operating Considerations and Experiences at El Convento,[1] by *O. H. Pfersdorff*, Electricidad de Caracas, Caracas, Venzuela

A Rapid Starting, Automatic Gas-Turbine Generating Plant for Peak-Load Duty,[1] *B. G. Markham*, Bristol, England

Joint Session—4 9:00 a.m.

Compressor

Compressor Performance Evaluation With Complex Gas Mixtures,[1] by *F. W. Peterson*, M. W. Kellogg Co., New York

Practical Stage Performance Correlations for Centrifugal Compressors,[1] by *F. Wiesner*, Carrier Corp., Syracuse, N. Y.

Correlation of Turbocompressor Performance With Various Gases,[1] by *C. A. Macaluso*, Worthington Corp., Harrison, N. J.

Hydraulic Division—Session 7 9:00 a.m.

Cavitation Symposium—2

An Effect of Air Content on the Occurrence of Cavitation, by *J. W. Holl*, Univ. of Nebraska, Lincoln, Neb. (Paper No. 60—HYD-8)

Influence of Entering Vorticity Field on Pump Cavitation,[1] by *Stefan Prelowski*, Borg-Warner Corp., Bedford, Ohio

Measurement and Observation of the Cavitation Phenomena in an Inlet Stage Axial-Flow Pump,[1] by *M. J. Hartmann*, and *R. F. Soltes*, NASA, Cleveland, Ohio

An Experimental Study of Cavitation in a Mixed-Flow Pump, by *G. M. Wood*, *J. S. Murphy*, and *J. Farquhar*, Pratt & Whitney Aircraft, Middletown, Conn. (Paper No. 60—HYD-7)

Cocktails in Exhibit Hall 11:30 a.m.–12:30 p.m.

Gas Turbine Power Division Luncheon 12:30 p.m.–2:30 p.m.

Speaker: *Walker L. Cisler*, ASME President

Exhibits Close 2:30 p.m.

Gas Turbine Power Division—Session 7 2:30 p.m.

The Behavior of Gas-Turbine Combustion Chambers While Burning Different Fuels,[1] by *C. Kind*, Brown, Boveri & Co., Ltd., Baden, Switzerland

Smoke Reduction in Residual Fuel-Burning Gas-Turbine Combustion System,[1] by *J. B. Gatzemeyer*, *R. B. Schiefer*, and *N. R. Dibelius*, General Electric Co., Schenectady, N. Y.

Hydraulic Division—Session 8 2:30 p.m.

Cavitation Symposium—3

Liquid Metal Cavitation—Problems and Desired Research,[1] by *F. G. Hammitt*, Univ. of Michigan

Cavitation Problems in Cryogenics,[1] by *R. B. Jacobs* and *K. B. Martin*, National Bureau of Standards, Boulder, Colo.

Some Cavitation Problems in Rocket Propellant Pumps,[1] by *M. C. Huppert*, *W. S. King*, and *L. B. Stripling*, Rocketdyne, Canoga Park, Calif.

The Problems vs. the Needs,[1] by *G. F. Wislicenus*, Pennsylvania State Univ.

National Automatic Control Conference Held in Dallas

A NATIONAL Automatic Control Conference was held Nov. 4–6, 1959, at the Sheraton-Dallas Hotel in Dallas, Texas. The conference was sponsored by the Institute of Radio Engineers—Professional Group on Automatic Control (IRE-PGAC)—with official participation by the American Institute of Electrical Engineers (AIEE), the Instrument Society of America (ISA), and the IRE Professional Group on Industrial Electronics; and with the co-operation of The American Society of Mechanical Engineers (ASME, Instruments and Regulators Division), and the Electrical Engineering Department of Southern Methodist University.

The Feedback Control Systems Committee of the AIEE (with other co-operating groups) sponsored a "Control Systems Components Conference," also at the Sheraton-Dallas Hotel, in parallel with the second and third days of the main conference. Their technical sessions were listed with those of the Control Conference.

Papers at Dallas. In the eight technical sessions, 37 technical papers were presented, of which four were ASME-sponsored. One, by R. Ash, W. H. Kim, and G. M. Kranc, all of Columbia University, presented a flow-graph approach for analyzing multiloop sampled-data systems. Two techniques for finding the sampled output are examined. Techniques developed are applied also

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[1] Paper not available—see box on page 127.

[1] Paper not available—see box on page 127.

to the solution of multirate systems.

R. E. Kalman of the Research Institute for Advanced Study, Baltimore Md., and J. E. Bertram of the IBM Research Center at Yorktown Heights, N. Y., presented a paper covering control-system analysis and design via the "second method" of Lyapunov, the most general approach currently in the theory of stability of dynamic systems. Only systems governed by differential equations are treated here. Systems governed by difference equations are the subject of a companion paper.

In the companion paper to the aforementioned, the second method of Lyapunov is applied to the study of discrete-time (sampled-data) systems. Theorems are stated in full, but motivation, proofs, examples, and so on, are given only when they differ materially from their counterparts in the continuous-time case.

A fourth paper took up "Optimal Computer Control." This paper is concerned with optimal computer control of a linear dynamic element or plant. The paper concludes with a discussion of the effects of uncontrolled inputs and certain problems encountered in making the system adapt to slow parameter variations.

Officials of the Conference. Principal Conference officers were: Louis B. Wadel, Chance Vought Aircraft, Inc., chairman; George S. Axelby, Westinghouse Electric Corporation, Technical Program chairman; and John M. Salzer, Ramo-Wooldridge, Special Program chairman.

Dr. Albert C. Hall, automatic control pioneer and currently Director of Research at the Martin Company, Denver, Colo., spoke at a combined National Automatic Control Conference—Control System Components Conference dinner meeting, Thursday, Nov. 5, at the Sheraton-Dallas Hotel.

ASME COMING EVENTS

March 6-9, 1960

ASME Gas Turbine Power and Hydraulic Conference, Rice Hotel, Houston, Texas.

March 14-15, 1960

ASME Lubrication Symposium, Engineering Societies Building, New York, N. Y.

March 29-31, 1960

American Power Conference, Hotel Sherman, Chicago, Ill.

March 31-April 1, 1960

ASME Textile Engineering Conference, North Carolina State College, Raleigh, N. C.

April 4-8, 1960

Nuclear Congress and Exhibit, Coliseum, New York, N. Y.

April 7-8, 1960

ASME-SAM Management Conference, Statler Hilton Hotel, New York, N. Y.

April 20-21, 1960

ASME-AIEE Railroad Conference, Penn-Sheraton Hotel, Pittsburgh, Pa.

April 25-26, 1960

ASME Maintenance and Plant Engineering Conference, Chase-Park Plaza Hotels, St. Louis, Mo.

April 25-29, 1960

ASME Metals Engineering Division-AWS Conference, Hotel Biltmore, Los Angeles, Calif.

May 17-19, 1960

ASME Production Engineering Conference, Hotel Schroeder, Milwaukee, Wis.

May 22-26, 1960

ASME Oil and Gas Power Conference and Exhibit, Muehlebach Hotel, Kansas City, Mo.

May 23-26, 1960

ASME Design Engineering Conference and Show, Statler Hilton Hotel, New York, N. Y.

June 5-10, 1960

ASME Summer Annual Meeting and Aviation Conference, Statler Hilton Hotel, Dallas, Texas

June 20-22, 1960

ASME Applied Mechanics Conference, The Pennsylvania State University, University Park, Pa.

June 27-29, 1960

ASME West Coast Applied Mechanics Conference, The California Institute of Technology, Pasadena, Calif.

August 15-17, 1960

ASME-AIChE Heat Transfer Conference and Exhibit, Statler Hilton Hotel, Buffalo, N. Y.

September 7-9, 1960

ASME Joint Automatic Control Conference, Massachusetts Institute of Technology, Cambridge, Mass.

September 15-16, 1960

ASME-AIEE Engineering Management Conference, Morrison Hotel, Chicago, Ill.

September 21-23, 1960

ASME-AIEE Power Conference, Bellevue-Stratford Hotel, Philadelphia, Pa.

September 26-28, 1960

ASME Petroleum Mechanical Engineering Conference, Jung Hotel, New Orleans, La.

October 9-12, 1960

ASME Rubber and Plastics Conference, Lawrence Hotel, Erie, Pa.

October 17-19, 1960

ASME-ASLE Lubrication Conference, Statler Hilton Hotel, Boston, Mass.

October 24-25, 1960

ASME-AIME Fuels Conference, Daniel Boone Hotel, Charleston, W. Va.

November 27-December 2, 1960

ASME Winter Annual Meeting, Statler Hilton Hotel, New York, N. Y.

(For Meetings of Other Societies see page 126)

Note: Members wishing to prepare a paper for presentation at ASME National meetings or divisional conferences should secure a copy of Manual MS-4, "An ASME Paper," by writing to the ASME Order Department, 29 West 39th Street, New York 18, N. Y., for which there is no charge providing you state that you are a member of ASME.

Applied Mechanics Reviews Reports Growth

The critical review magazine, *Applied Mechanics Reviews*, dealing with a broad field of international coverage, recently has completed its twelfth year. The magazine is edited at Southwest Research Institute in San Antonio, Texas, and published by The American Society of Mechanical Engineers. During the past year, the magazine underwent a great expansion program. The number of reviews published has been increased by 50 per cent from the 1957 level.

The growth is attributed to a large extent to the explosive expansion of the technical literature following as a natural consequence the opening of new fields of research including magneto-fluid-dynamics, and the publication of several new technical periodicals.

The quantity of the Russian literature also has increased considerably. Steady progress, *Applied Mechanics Reviews* reports, has been made since 1957 to publish the English translation of the reviews of Russian articles appearing in the *Referativnyi Zhurnal*. These translations are provided by the British Ministry of Supply. The microfilms of the original Russian papers are received from the National Institute of Information in Moscow, and while the time lag cannot be disregarded, constant improvements are being made. The permanent depository of the *Applied Mechanics Reviews* at the

Linda Hall Library in Kansas City, Mo., thus is accumulating an invaluable source of Russian research articles, many of which otherwise would be unavailable in this country.

The subject field of applied mechanics has grown so rapidly in recent years that reorganization became imperative. Some 50 specialists helped the *Applied Mechanics Reviews* staff in this task and the result is a list of topics composed of 50 major and some 500 minor headings which has received enthusiastic acceptance during the past year. This list is used by the staff of the magazine as an aid to find the proper reviewer for a technical article and can be used also for educational purposes.

The list, printed in the form of a 23-in. × 15-in. wall chart, may be obtained upon request addressed to the Editorial Office of Applied Mechanics Reviews, Southwest Research Institute, 8500 Culebra Road, San Antonio 6, Texas.

1960 RAC Meetings Schedule

Date	Days	Location	Hotel	Region	Section
April 9–10	Sat-Sun	Columbia, S. C.	Columbia	IV	CSRA
April 11–12	Mon-Tue	Syracuse, N. Y.	Syracuse	III	Syracuse
April 20–21	Wed-Thur	Mexico, D. F.	Continental Hilton	VIII	Mexico
April 1–2	Fri-Sat	Los Angeles, Calif.	Disneyland	VII	Los Angeles
April 25–26	Mon-Tue	Cincinnati, Ohio	Carrousel	V	Cincinnati
April 29–30	Fri-Sat	Minneapolis, Minn.	Normandy	VI	Minnesota
May 2–3	Mon–Tue	Garden City, L. I.	Garden City	II	Metropolitan
May 6–7	Fri-Sat	New London, Conn.	Mohican	I	New London
Palm Sunday	April 10				
Good Friday	April 15				
Easter Sunday	April 17				

Freeman Fellowship for Study or Research in Hydraulics

Qualified members of The American Society of Mechanical Engineers or the American Society of Civil Engineers who have a worthy research program in hydraulics or related fields, may apply for fellowship support to the Freeman Award Committee of ASME. The next award can be as much as $3000, depending on the need claimed in the application.

The ASME and ASCE are joint administrators of the Freeman funds. The Freeman Award Committees make awards through these Societies in alternate years (through the ASME Committee in 1960). The conditions under which fellowship applications will be studied are the following:

1 Each applicant must submit a study or a research program covering a period of at least nine months starting in 1960. Each shall include a statement of the funds needed from the fellowship.

2 Each applicant shall furnish evidence of his qualifications to carry out the proposed program.

3 Applicants must be citizens of USA and members of either of the two co-operating Societies.

4 Applications must be submitted to the Freeman Award Committee, c/o Secretary, The American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y., by April 15, 1960.

5 Announcement of the Award will be made when the recipient has been selected.

6 A report in English must be made by the awardee within 60 days after completion of his project.

7 The income from the Fund is to be used in the aid and encouragement of young engineers, especially in research work for:

(*a*) Grants toward expense for experiments, observations, and compilations to discover new and accurate data that will be useful in engineering.

(*b*) Underwriting fully or in part some of the loss that may be sustained in the publication of meritorious books, papers, or translations pertaining to hydraulic science and art which might, except for some such assistance, remain mostly inaccessible.

(*c*) A prize for the most useful paper relating to the science or art of hydraulic construction.

(*d*) A traveling scholarship, open to members younger than 45 years, in any grade of membership, in recognition of achievement, or promise and for the purpose of aiding the candidate to visit engineering works in the United States or any other part of the world where there is good prospect of obtaining information useful to engineers.

(*e*) Assisting in the translation, or publication in English of papers or books in foreign languages pertaining to hydraulics.

Partial Program Announced for 1960 Nuclear Congress

A partial program of sessions planned for the 1960 Nuclear Congress, to be held in the New York Coliseum, April 4–7, has been announced by Clarke Williams, chairman of the Nuclear Engineering Department of the Brookhaven National Laboratory, Upton, N. Y., and chariman of the Nuclear Congress.

The Congress. The Congress, a gathering of representatives from all areas of the nuclear field, is sponsored by 28 leading engineering, scientific, management, and technical organizations, of which The American Society of Mechanical Engineers is one. It consists of the sixth Nuclear Engineering and Science Conference, the eighth NICB Atomic Energy in Industry Conference, and the sixth International Atomic Exposition.

The Exposition. The Exposition, which was established in 1954, will include at least 130 exhibits of the manifold products and services available for the peaceful use of atomic energy. More than 1000 requests for information regarding participation in the exhibit have been received from firms all over the world, indicating an exceptional interest.

The Theme. The theme of the meeting, will be—"What Will the Future Development of Nuclear Energy Demand From Engineers?" This question will be approached through a series of reports, papers, and discussions on a wide variety of subjects related to the peaceful use of atomic energy.

ASME Elects Seven to Grade of Fellow

The American Society of Mechanical Engineers has honored seven of its members by electing them to the grade of Fellow of the Society.

To be qualified as a nominee to the grade of Fellow, one must be an engineer with acknowledged engineering attainment, have 25 years of active practice in the profession of engineering or teaching of engineering in a school of accepted standing, and be a Member of the Society for 13 years. Promotion to the grade of Fellows is made only on nomination by five Fellows or Members of the Society to the Council, to be approved by Council.

The men who were so honored for their outstanding contributions to their profession and to the Society are:

Paul Gravelle

Paul Gravelle, chief mechanical engineer, Toledo Edison Company, Toledo, Ohio, is recognized for his outstanding contributions in the field of mechanical power-plant design. His career with The Toledo Edison Company began in 1922, and since that time he has steadily accumulated a list of power-plant-engineering accomplishments. A few of the list includes the use of multistage high-pressure heaters with identical tube bundles for each boiler installation; refinement of boiler combustion control by metering air flow across segmental orifices arranged in tubes on the inlet of forced draft fans; the use of tubular air heaters with separate tube sheets in the lower coal section to facilitate more frequent tube replacement required in the corrosive area of the air heater. Within the past 15 years, he has been responsible for the design, arrangement, and selection of equipment of central station units in Toledo. He was also among the pioneers in the development of combustion, steam-temperature, and boiler-feedwater controls to bring about completely automatic operation of large central stations resulting in higher plant efficiency. Mr. Gravelle has contributed greatly to the over-all effort to increase plant efficiency and to reduce cost per kw of installed capacity by utilizing relatively large steam turbines in relation to the system peak load. Mr. Gravelle has devoted considerable effort to the education and encouragement of young engineers. He was one of a group of engineers who assisted in the growth of the Engineering College at the University of Toledo from a three to a four-year college. This group of engineers also offered their teaching services on a part-time basis, making possible the eventual accreditation of the school. Mr. Gravelle has also been a member of the group which did the groundwork for the first air-pollution control ordinance in the City of Toledo. He has served the Society as chairman of the Toledo Section, 1945; and he is currently serving his third term on the Section Executive Committee. He is a member also of the Prime Movers Committee of Edison Electric Institute. Mr. Gravelle is a registered professional engineer in the State of Ohio.

D. M. Palmer

Delos Marquis Palmer, consulting engineer, Toledo, Ohio, has contributed to the engineering profession not only as a practicing engineer at the head of the firm which bears his name, but also as an educator. In 1945 Mr. Palmer organized the firm of Delos M. Palmer & Associates, consulting engineers, which today has 20 employees who concentrate on the design of special machinery and automation. From 1930 to 1943 he was dean of engineering at the University of Toledo. Under his direction the curriculum at the school's Engineering College was expanded to four years and subsequently accredited by ECPD in 1942. Dean Palmer was also responsible for the development of three laboratories—mechanical, metallurgical, and hydraulic—at the college. Mr. Palmer has served the Society as chairman of the Toledo Section, 1934. He is a member also of the American Ceramic Society, SPEE, NSPE, OSPF, ASM, the Engineering Society of Toledo (Hon. Mem., 1959), and Tau Beta Pi. In 1956, he was named Engineer of the Year by the Toledo Technical Council. He holds three patents. He is a registered professional engineer in Ohio and Michigan.

Paul E. Holden

Paul Eugene Holden, professor of industrial management, Graduate School of Business, Stanford University, Stanford, Calif., has devoted his energies to the application of management principles in numerous professional activities, and to the extension of the knowledge of management through research. Professor Holden has been on the Stanford faculty since 1926. At the same time, he has acted as adviser on many management problems in industry and business, and his counsel has been of inestimable value to the economic life of the Pacific Coast. In the sphere of management research he made a notable contribution to the safety and production-research survey of the American Engineering Council in 1926; and, more recently, has directed and brought to completion a significant research study on management policies and practices of a group of leading American industrial corporations. In the area of

Ernst W. Allardt, **left**, then Vice-President, ASME Region V, makes presentation of ASME Fellow-grade certificates to Paul H. Gravelle, Ernest W. Weaver, and Delos M. Palmer public service, he has acted as administrative adviser to the Priorities Division of the Office of Production Management. He served also on the War Production Board, and was a member of the Advisory Commission, American Trust Company. For his many and diverse contributions in the application of management principles in business and industry, in the U. S. and abroad, he received the Gantt Medal in 1941. He is the coauthor of several books: "Selected Case Problems in Industrial Management," 1953; "Top Management Organization and Control," 1942; and "Cost and Production Handbook," 1934. He is a contributor and consulting editor to a number of publications. He is a member of the Newcomen Society, SAM, and Tau Beta Pi. During World War I, Professor Holden was a captain in the U. S. Army, Ordnance.

G. Sinding-Larsen

Gunnar Sinding-Larsen is president of Pittsburgh Piping and Equipment Company, Pittsburgh, Pa. He is a nationally recognized authority on the design of high-pressure, high-temperature piping systems. Mr. Larsen was educated in Norway and received his early experience with the Norwegian State Railways. Coming to America in 1921 he was employed by J. G. White Company, Consolidated Edison Company of New York, and Sanderson and Porter. He joined Pittsburgh Piping in 1924 as a design engineer; was made chief engineer in 1938; vice-president in 1947; and in 1954 assumed the office of president. He has been responsible for the establishment and direction of a Fellowship with the University of Pittsburgh for the design and development of Scale Model Test Apparatus to determine and analyze stresses in power-plant piping systems. This apparatus is used extensively in determining the movement and stresses of main steam and hot reheat piping in the intermediate ranges of 2000 psi at 1050 F as well as the supercritical range of 3500 psi at 1100 F. Mr. Larsen has made many contributions as a committee member. He has served on the Subcommittee on Fabrication Details of the American Standard Code for Pressure Piping; the Subcommittee of the Sectional Committee on Standardization of Pipe Flanges and Fittings. He is a member also of Sectional Committee ASA B31.1, Code for Pressure Piping; and has served as chairman of the Subcommittee on Fabrication Details of ASA B31.1. Mr. Larsen is the author of numerous papers and lectures on the subject of power-plant piping systems. He is a registered professional engineer in Pennsylvania.

Herbert Estrada

Herbert Estrada, manager, Station Operating Department, Philadelphia Electric Company, Philadelphia, Pa., has been with the utility since 1923. In his current post since 1950, he is responsible for the production facilities of the company including eight steam-electric and one hydroelectric generating stations and substations. He is also responsible for the co-ordination of the following division functions: Coal Bureau and Steam Heating Division, Maintenance Division, Load Dispatching Division, the Chemical Laboratory, and the Station Economy Division.. Mr. Estrada has written extensively on the subject of power-station design and operation, and his work has been published in *Electrical World* and in the *AIEE* and *ASME Transactions*. He has served the Society as a member of the Executive Committee of the Power Division from 1952 to 1958; as secretary from 1952 to 1953; and from 1956 to 1957 as chairman. Currently, he is a member of the ASME Medals Committee and in 1959 chairman of the Worcester Reed Warner Medals Subcommittee. He has also been a member, and chairman, of the Joint AIEE-ASME Committee on a Recommended Specification for Prime Movers Speed Governing and a member of the Joint ASME-ASTM Research Committee of Boiler Feedwater Studies. He served also on ASME Power Test Code Committee #20 on Speed, Temperature and Pressure Responsive Governors. He was a member of the Prime Movers Committee of the Pennsylvania Electric Association and the Edison Electric Institute. Mr. Estrada is a member also of AIEE and The Franklin Institute. He is a registered professional engineer in the Commonwealth of Pennsylvania.

Andrew B. Holstrom

Andrew Birger Holmstrom is vice-president of the Norton Company, Worcester, Mass. His career, however, has been marked not only by distinct engineering achievement, but also by accomplishments in political life. With the exception of five years, 1924–1929, during which Mr. Holmstrom was Superintendent of Sewers, City of Worcester, Mass., he has been with the Norton Company since 1919. In the 1930's he was sent to England to supervise construction of the Norton Grinding Wheel Company at Welwyn Garden City. It was there that the discovery of a water-filled underground cavern at the building site posed a difficult problem. Mr. Holmstrom's solution: Construct a huge concrete slab over the entire plant area and "float" the plant on the surface. His recent accomplishments have been in the field of management. He has held important offices in his company while simultaneously heading a variety of civic committees. He entered politics in 1949, was elected a city councilor by the largest majority of any of the candidates. He has been re-elected every two years since then, and in 1950 he was elected Mayor. In his conduct in public office, he has consistently upheld the highest traditions of engineering. Mr. Holmstrom holds a patent for a method of balancing grinding wheels. He is a member of the Manufacture Committee of the U. S. Chamber of Commerce, the National Industrial Conference Board, director of the Council for International Progress in Management (U. S. A.), Inc., and he is a trustee of Worcester Polytechnic Institute. He is a member also of ASCE and SAM. He is a registered professional engineer in the Commonwealth of Massachusetts.

L. D. Martin

Louis David Martin retired after 30 years as a gear engineer with Eastman Kodak Company, Rochester, N. Y., and formed L. D. Martin Associates Gear Engineering Company in 1956. He is now located in Pasadena, Calif., where he has opened a gear-consulting office and a gear-equipment sales organization. While with Eastman, Mr. Martin was responsible for all gear design and engineering involving some extremely accurate gear design and manufacture. He was responsible also for gear-checking and gear-cutting equipment. Mr. Martin also designed the Kodak Conju-gage Gear Checker and novel gear shaping equipment. Many of the fine techniques now used in the field of fine-pitch gearing can be traced directly to him. Through his efforts the Fine-Pitch Gearing Committee of the American Gear Manufacturers' Association was organized and he became the first chairman. Under his direction the current fine-pitch standards were developed as AGMA Standards and were later accepted as American Standards. One of these standards, "Inspection of Fine-Pitch Gears," is virtually the handbook for fine-pitch gear manufacturers. Mr. Martin is recognized as being one of the first to apply crossed-axes gear shaping to fine-pitch gears. During World War II, this application contributed to higher accuracy in such gears. He holds 37 patents pertaining to gears. He is the author of over 53 papers published in the technical press. In 1948 AGMA presented him with the Edward P. Connell Award for his immeasurable contributions to the gearing industries.

Conducted for the National Junior Committee

A. S. GOLDSTEIN

JUNIOR FORUM

How to Double Your Income

During the 1959 ASME Annual Meeting in Atlantic City, a panel at the Junior Session was chaired by Robert E. Jonelis[2] and assisted by W. M. Morely,[3] vice-chairman, who were greeted by the warming sight of perhaps the most enthusiastic attendance in the memory of even the veterans. Gratifying, too, was the improved ratio of Associate Members to their seniors in the audience. Considering the topic, "How to Double Your Income," no one was entirely surprised. True, the title was chosen to arouse interest, but not even the most naive could have attended with the serious expectation of hearing an oracle utter the magic formula that would enable him to return to work the following week and in one grand gesture effect anything like a salary double. If the naive was there, he could have become enlightened with wisdom of much greater long-range value than twice his income.

The fact of the matter was, if we had not already done so, statistics indicate that we would double our salary. It would be accounted for by one's normal increase in productivity, supply and demand of engineers, general prosperity level, inflation, and other factors beyond the individual's control.

Sales Engineer's Viewpoint

F. R. Danker[4] responded to the question from the standpoint of the sales engineer, starting with the fact that over the span of the past 13 years starting salaries of graduates have doubled and today's salary of an engineer who was graduated ten years ago has already doubled. The logical deduction then, made in jest, is to make like a college graduate, changing jobs each year for 13 years, or just sit tight and look intelligent for ten years. We also can eliminate the boss's daughter as a means of doubling one's salary because there aren't enough to go around.

Going from there, Mr. Danker offered some ageless advice intended to increase one's value and earnings at the maximum rate. Work hard, get orders, be motivated by loyalty to your company's interests rather than self-aggrandizement, and patience. You must perform all the services to your customer better than your competitors and even noticeably better than your coworkers. You must present ideas to management for improving over-all effectiveness and for product improvement. Summarizing, Mr. Danker said, "There is no pat answer. We must revert then to the laws of competition, supply and demand, where only your own ideas, ability, patience, and hard work will determine if you will double your income sooner than the median of the statistics."

Consulting Engineer's Viewpoint

Warren R. Thompson,[5] speaking from the viewpoint of the consulting engineer, also recognized from statistics that incomes have doubled. Statistics, though, did not indicate why nor did they reveal the means by which those above average attained their eminence. Professional development, a much-used term, was given credit for influencing the rate of salary increase. Mr. Thompson offered an original definition which gives a better insight as to what "professional development" is: "Let it be sufficient to say that when the young engineer has the inspiration, desire, and hard drive to want to be a better and more competent engineer, he is on the road to professional development."

Looking further at the matter of relating income to engineering work, he noted three levels: (1) Technical competence where physical laws and data are dealt with; (2) technical judgment where mature experience must be relied upon to provide part of the answer; and (3) policy making where decisions of direction and goals are made. Each of these levels has progressively higher salaries. What is the common element that gives an index of the salaries? Mr. Thompson suggested, "Is it possible that our income, in the long run, is in direct proportion to the wise use of our judgment and willingness to assume the responsibility for the decisions we make?"

All of the speakers realized that it was all in the realm of probability to double one's salary.

Jonelis

Morley

Buscemi

Thompson

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[1] Engineering writer, General Electric Advanced Electronics Center at Cornell University, Ithaca, N. Y. Assoc. Mem. ASME.

[2] Engineer, Commonwealth Edison Company, Chicago, Ill. Assoc. Mem. ASME.

[3] Sales Department, Stock Equipment Company, Cleveland, Ohio. Assoc. Mem. ASME.

[4] Department Manager—Power Applicance, American Standard Ind. Division, Chicago, Ill. Assoc. Mem. ASME.

[5] Power Engineer, United Engineers & Constructors, Philadelphia, Pa. Assoc. Mem. ASME.

Keep Your ASME Records Up to Date

The ASME Secretary's Office depends on a master membership file to maintain contact with individual members. This file is referred to countless times every day as a source of information important to the Society and to the members involved. All other Society records are kept up to date by incorporating in them changes made in the master file.

The master file also indicates the Professional Divisions in which members have expressed an interest. Many Divisions issue newsletters, notices of conferences or meetings, and other material. You may express an interest in the Divisions (no more than three) from which you wish to receive any such information which might be published.

Your membership card includes key letters, below the designation of your grade of membership and year of election, which indicate the Divisions in which you have expressed an interest. Consult the form on this page for the Divisions to which these letters pertain. If you should wish to change the Divisions you have previously indicated, please so notify the Secretary.

It is highly important to you and to the Society to be certain that our master file indicates your current mailing address, business or professional-affiliation address, and interests in up to three Professional Divisions.

Please complete the form, being sure to check whether you wish mail sent to your residence or office address, and mail it to ASME, 29 West 39th Street, New York 18, New York.

Please Print

ASME Master-File Information

Date

LAST NAME FIRST NAME MIDDLE NAME

POSITION TITLE NATURE OF WORK DONE

e.g., Design Engineer, Supt. of Construction, Manager in Charge of Sales, etc.

NAME OF EMPLOYER (Give name in full) Division, if any

*☐

EMPLOYER'S ADDRESS City Zone State

ACTIVITY, PRODUCT, or SERVICE OF EMPLOYER; e.g., Turbine Mfrs., Management Consultants, Oil Refinery Contractors, Mfr's. Representative, etc.

*☐

HOME ADDRESS City Zone State

☐

PRIOR HOME ADDRESS City Zone State

* CHECK "FOR MAIL" ADDRESS

I subscribe to

	Address changes effective when received prior to:
☐ Mechanical Engineering	10th of preceding month
☐ *Journal of Engineering for Power*	20th of preceding month
☐ *Journal of Engineering for Industry*	
☐ *Journal of Heat Transfer*	
☐ *Journal of Basic Engineering*	
☐ *Journal of Applied Mechanics*	
☐ *Applied Mechanics Reviews*	1st of preceding month

Professional Divisions in which I am interested (no more than *three*) are marked X.

☐ A—Aviation
☐ B—Applied Mechanics
☐ C—Management
☐ D—Materials Handling
☐ E—Oil and Gas Power
☐ F—Fuels
☐ G—Safety
☐ H—Hydraulics
☐ I—Human Factors Group
☐ J—Metals Engineering
☐ K—Heat Transfer
☐ L—Process Industries
☐ M—Production Engineering
☐ N—Machine Design
☐ O—Lubrication
☐ P—Petroleum
☐ Q—Nuclear Engineering
☐ R—Railroad
☐ S—Power
☐ T—Textile
☐ U—Maintenance and Plant Engineering
☐ V—Gas Turbine Power
☐ W—Wood Industries
☐ Y—Rubber and Plastics
☐ Z—Instruments and Regulators

Design Engineer's Viewpoint

V. P. Buscemi[6] lost no time dwelling on that point. He went right to the question of how to have your salary follow the upper curve of the minimum and maximum growth tendencies. The search for recognition summarizes several techniques which are believed will be rewarded by salary increases and promotions. Recognition would be obtained by being noticeably energetic, meticulous, and orderly in detail no matter how trivial. Making one's well-conceived ideas known to his supervisor, even if they differ, will be viewed as worthy of interest in the company. Extracurricular activities at work and home are not often thought of as particularly meritorious in personal development after college. Mr. Buscemi offered his own experience of managing social and civic functions in and out of work to demonstrate that management does attach importance to this. Special assignments from the boss were viewed as recognition and an opportunity for additional recognition. Here, one can show his willingness and ability to assume responsibility by approaching his superior with "This is how I plan on carrying out your assignment" rather than "What should I do next?"

Following the three prepared statements, questions from the floor, to which most of the meeting was devoted, were directed to the panelists. A question that resulted in spirited discussion with opposing opinions was, "Do you recommend asking for a raise?" All of the panelists had comments but not all in agreement. The one extreme, that a person should practically have a standing request for a raise, was expressed. On the other hand, the chief engineer of a leading consulting engineering firm who was in the audience volunteered that in his entire career he had never asked for a raise and that he felt well taken care of. The more commonly held opinion was that under the proper circumstances, considering the company's P & L statement, any recent outstanding achievement of the individual or addition to his work load and responsibility, it could be quite in order to request a review of one's salary.

To put the minds of employers at ease, it might be said that in no case was there any malice reflected against salary levels and this meeting was not a conspiracy to plan a mass uprising by the young engineers. Everyone seemed to have confidence that his employer treated him as well as conditions would allow.

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[6] Senior Engineer, Large Turbine Engineering, Westinghouse Electrical Corp., Lester, Pa. Assoc. Mem. ASME.

Food for thought was presented in the fact that mechanical engineers ranked second from the bottom above civil engineers in the wage scale of five branches of the profession. This didn't seem to disturb anyone. The average salary of mechanical engineers ten years out of college was $9760 according to the 1958 NSPE survey.

Throughout the meeting, beginning with the opening fall of the gavel, between speakers, and in handling of the questions, Mr. Jonelis provided continuity for the discussions with his pearls of wisdom on employee relations and money. Following is a sample with which he closed the meeting:

On Money—

Husk of many things, not the kernel;
Brings food, not appetite;
Brings medicine, not health;
Brings acquaintances, not friends;
Brings servants, not loyalty;
Brings days of joy, not peace and happiness.

ESPS Announces a New Service to Employers and Employees

The Engineering Societies Personnel Service, Inc., recently announced a new bulletin of "Engineers Available" will be published and distributed biweekly to several thousand employers in the eastern states. This bulletin, first issue, Dec. 1, 1959, will be distributed free of charge and will contain a short synopsis of the experience of engineers who have registered with the Service and are seeking a new position. This new publication is part of an expanded program designed to increase the effectiveness of the service to both employer and employee.

Any employer interested in receiving this bulletin should so advise ESPS at 8 West 40th Street, New York 18, N.Y., and your name will be placed on our mailing list. Any engineer who is registered with the Service or wishes to register is entitled to a 35-word notice in the bulletin. Write to the New York office for forms. Your qualifications will be brought to the attention of employers on our mailing list without revealing your identity.

It is planned that this publication will be extended shortly to include the midwestern office, located at 29 East Madison Street, Chicago, Ill., and the western office at 57 Post Street, San Francisco, Calif.

The present employment market for engineers is active and there are positions available in management, operations, design, research, and development as well as in sales, and the like. Therefore those engineers who are really seeking new positions are encouraged to register with the Service at this time giving us the opportunity of processing your registration and making direct referrals to positions for which we believe you would be qualified and interested in. Utilize the services offered by ESPS to your advantage.

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC
[Agency]

These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which co-operates with the national societies of Civil, Electrical, Mechanical, and Mining, Metallurgical, and Petroleum Engineers, is available to all engineers, members or nonmembers, and is run on a nonprofit basis.

If you are interested in any of these listings, and are not registered, you may apply by letter or résumé and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 5 per cent of the first year's salary if a nonmember, or 4 per cent if a member. Also, that you will agree to sign our placement-fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include eight cents in stamps for forwarding application to the employer and for returning when possible.

NEW YORK
8 West 40 St.

CHICAGO
29 East Madison St.

SAN FRANCISO
57 Post St.

Men Available[1]

New York Office

General or Plant Manager, BSME; 59; 36 years manufacturing and general management in leading industrial companies; intricate electromechanical devices. Prefers East. Me-769.

Sales and Marketing Engineer, BS; 29; five years liaison activities with foreign and domestic firms; installation and development of navigational fire-control equipment. Foreign location. Me-770.

Designer, Mechanical Engineer, Certificate; 51; 29 years in field and office assignments; design calculations, layout of piping systems, power-plant equipment and specialties, instrumentation, inspection, and checking. New York City. Me-771.

Chief Engineer, BSME; 36; 15 years' experience in nuclear pipe fabrication and erection, radiography, design and manufacturing of nuclear components. Recognized for ability to organize and standardize, and cost-reduction record. Will consider fee-paid jobs only. Me-772.

Chief Manufacturing Engineer, ME; 36; 14 years' experience in engineering, manufacturing, development, etc., in aircraft, ordnances, telephonic communications, TV-Radio assembly, welding fittings. Mid or West Coast. Me-773.

Executive Engineer, ME; 44; three years' experience in domestic tank-manufacturing company, 19 years' in negotiating and execution of all types of engineering, heavy equipment, and construction projects throughout the world. Prefers New York, N. Y. Me-774.

Mechanical Engineer, ME, PE, MBA; 30 years' experience administrative engineering standards, specifications, correspondence, calculations on power-plant equipment, and accessories. Prefers New York area. Me-775.

Mechanical Designer or Mechanical Engineer, BSME, N. Y. State Professional Engineer; electric-power plants, 21 years; oil-refinery plants, 1½ years; portland cement plants and machine design, 7 years; tar products and tar distillation, 2½ years. New York City and vicinity. Me-776.

Plant Manager, BSME; 38; 7 years as manufacturing and engineering manager in aluminum and plastic fields. Thoroughly familiar with design, production engineering, production control, and manufacturing. East, Midwest, South. Me-777.

Chicago Office

Engineering Manager, MSME; PE; 40; 12 years' responsible project supervision in automotive and related engine, accessory, chassis, and control design and development, six including planning, management presentations and administration. Analysis, design, test, demonstration; computer analysis of systems; lab tests and experimental car operation. Location immaterial. Me-979-Chicago.

Vice-President, Engineering, Consulting Engineer, BSME; 46; 25 years engineering management, product engineering, design, development, consulting engineering, internal-combustion engines, heavy equipment, hydraulics, pneumatics, valves, etc. Location immaterial. Me-1017-Chicago.

Mechanical Engineer, BME; 30; four years mechanical-engineering research including combustion, fluid flow, heat transfer, design, fans and blowers, dust separation, erosion, conveying, electronics, and filtration. Location immaterial. Me-1020-Chicago.

Works Manager, BSIE; 42; 20-year cost-reduction record achieved through organization, administration, co-ordination of industrial engineering, plant engineering, industrial relations, and production (all phases) in heavy machinery, metal-fabrication industries; single and multiplant operations. Far West. Me-1024-Chicago.

Product, Personnel, Design, Development, MSME; 49; over 12 years at chief-engineering and planning-staff levels. Background includes rotating machinery, materials handling, industrial noise control, domestic appliances, internal-combustion power plants, structural components, weapons and food processing, problem solving, and policy-making experience in products, methods and personnel development areas. Spans research, development, and design spectrum. Location immaterial. Me-1025-Chicago.

Plant Engineer, Manager, Estimator, MSME; 32; strong construction, estimating, manager background; 7½ years' experience take-off and estimating, supervision and engineering of industrial, commercial and residential plumbing, heating, air-conditioning, and refrigeration jobs. Midwest. Me-1026.

San Francisco Office

Design, Development Engineer, MSME, 42. Sound engineering background and administrative ability, 13 years varied manufacturing design, shop sales, customers and technical societies liasion, mechanical and hydraulic equipment,

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[1] All men listed hold some form of ASME membership.

Additional listings of positions and men available are maintained in the offices of E.S.P.S. Direct inquiries to nearest office. A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members; $4.50 per quarter or $14 per annum for nonmembers, payable in advance.

instrument and medium-sized mechanisms, fluid flow, hydraulic controls, metallurgical. $9600–$12,000. Prefers San Francisco Bay area. Home: Calif. Se-1605.

Superintendent, Maintenance Engineer, 41. 17 years' experience in charge of design, maintenance, repairs, construction, installation on diesel locomotives, dump cars, trucks, construction equipment, refiners, hydraulic presses, equipment for sugar factory and marine railways, hardboard plant, nickel mining and processing. $9000. Prefers Calif. Southwest. Home: Cuba. Se-1593.

Vice-President or Chief Engineer, ME, 35, 13 years' experience as vice-president for management consultant; charge of engineering, estimating, costs for gas, power, telephone-utility construction, expansion, operation for construction company and utility; co-ordinate engineering, construction, planning, scheduling of atomic energy plants. $15,000. Any location. Home: Canada. Se-1589.

Sales Manager, ME, 40, 13 years sales, sales application, engineering, contacting engineers, purchasing, superintendents. Interested in aircraft, missiles or construction field. $10,000. Prefers West Coast. Home: Calif. Se-1525.

Designer, Sales Engineer, ME, 27. One year's experience on engine lubrication system accessories, structures, components for aircraft manufacturer. $7200. Prefers San Francisco Bay area. Home: S. Calif. Se-1418.

Sales Engineer, ME, 33. Direct sales to industrial, commercial, and government western states in custom engineered capital equipment. Experienced in high-level negotiation, application engineering, estimating and market study. Seeking challenging position in sales promotion of engineered product of merit. Presently sales manager with well-known Bay Area firm. $10,000+. Prefers N. Calif. or any. Home: San Francisco East Bay. Se-1536.

Industrial Engineer, Engrg. Adm., 53. Vice-President engineering and former treasurer of national food processor, experienced automatic packaging and related fields, work simplification, method analysis, high-speed conveyers, material-handling systems, management controls and reports, office procedures, cost analysis, product development, plant layout, refrigeration, and warehousing. $12,000. Prefers West Coast. Home: Calif. Se-1516.

Estimator, Sales Inspector, 55. Well experienced, liaison with shop personnel on new facilities and physical control of steel fabrication, operation and maintenance of steam-pumping plants, chief draftsman on refinery and chemical projects, inspection of marine equipment, instruction on ship construction and metal trades. $6600. Prefers San Francisco Bay Area. Home: San Francisco. Se-1377.

Junior Mechanical Engineer, ME, 25. Recent graduate, six months' experience on design of plant equipment for metal-products manufacturer. Interested in heat-transfer, air-conditioning, or thermodynamics research or design. $5700. Prefers San Francisco Bay area. Home: San Francisco East Bay. Se-1362.

Designer or Quality Control, MSME, MBA, 30. Seven years quality control, inspection, systems engineer on rocket engines, electromechanical systems, machine tools, fire and navigation controls; process, test, design, schedule, patent records, develop nuclear control devices, production. Also three years' experience in lab test, development of petroleum products, research and development. $10,200. Prefers San Francisco Bay area or any. Home: Central Calif. Se-1359.

Sales Engineer, 51. 30 years' experience sales manager of sales of industrial oil burners and boilers, steam generators, aircraft engines, distribution and power transformers for manufacturers. $12,500. Prefers San Francisco Bay area. Home: San Francisco East Bay. Se-1315.

Sales Engineer, ME, 35. Nine years supervising plant operations, schedule, budget, machine shop, welding, design of products for manufacturer of instruments, control systems, burners, gas equipment. $8400. Prefers San Francisco Bay area or Denver. Home: San Francisco Peninsula. Se-1318.

Designer, EE, 41. 12 years design, supervision of construction of power plants, military bases, substations, distribution systems, pump stations. One year operation and maintenance of diesel ships. $10,000. Prefers Foreign, Calif., or South. Home: San Francisco. Se-1303.

Sales Engineer, 41. Registered PE in Calif., 20 years marketing background of tangible and intangibles, experienced from private practice viewpoint. Can handle unlimited responsibility. Salary, base plus commission. Any location. Home: Calif. Se-196.

Positions Available

New York Office

Sales Engineer, Hydraulics, graduate mechanical or electrical, interested in the area of control systems, for a small consulting research group to obtain hydraulic-research contracts. At least two years' engineering-development work, preferably in the areas of hydraulics and electronics and at least three years' sales experience. $9600–$10,800. Company pays placement fees. Considerable travel. Mass. W-8306.

Staff Assistant for Management Personnel Department, young, degree in engineering, plus a master's degree in Business Administration desired; one to three years' experience, preferably with industrial company, in personnel, but also may be in engineering, sales, operating, etc. This is a training position for the following areas: Employment and college relations, management training, and development. Extensive travel to schools, division headquarters, and plants throughout the country. $6000-$7000 to start. Company pays placement fees. Headquarters, New York, N. Y. W-8305.

Mechanical Engineer, graduate or equivalent experience, flare for original thinking in developing new product designs using metal, plastic and rubber—having intimate contact with product from inception to pilot production. Permanent position with excellent growth opportunity. Northwestern Pa. W-8301.

Packaging Engineer, graduate mechanical, minimum of three or four years' experience in a packaging function; some packaging maintenance and repair programs experience required. Will be responsible for the modifications and changes of packaging equipment and will work with packaging and shipping superintendents in training of packaging machine attendants. $8220–$9600. Mass. W-8296.

Application-Design Engineer, mechanical or chemical-engineering graduate preferred, application and design experience, preferably on liquid-ring vacuum pumps and compressors, but will consider centrifugal-pump experience. Demonstrated ability to generate creative application and design proposals and experience in putting creative ideas into practice. $8000–$10,000; $10,000, and up for patent holder. Conn. W-8285(*a*).

Sales Contact Engineer, graduate mechanical, five to ten years' experience, for promotional and public relations with industry and government, for large research organization. Should have experience in wide range of mechanical-engineering activities. $12,000–$15,000. Company pays placement fee. W-8283.

Senior Mechanical Engineer, BS and MS, seven years' experience in applied mechanics, dynamics, heat transfer, and fluid flow. Teaching experience in advanced engineering subjects desirable. Will work on technical staff offering technical assistance to engineering labs. $10,000–$12,000. Company pays placement fee. Conn. W-8273.

Associate Professor of Mechanical Engineering, MS and some teaching experience. Will be responsible for courses in heat power, thermodynamics, and manufacturing processes. $6000–$8000. South. W-8270.

Operation and Management Personnel for company operating a cement plant, ice plant, and brewery; experience in engineering, chemistry, business, and personnel management. Should be capable of filling top-management positions after a year or two. Salaries good. Apply by letter giving complete history with salary requirements, family responsibilities, and other pertinent facts. South America. F-8267.

Labor-Standards Manager, not over 45, to be responsible for the development and direction of company's labor standards programs. Will administer wage-incentive program, handle union relations relating to incentives and standards, and carry out methods-research projects. Background in needle trades desirable but not essential. Knowlege and experience in MTM desirable. $12,000–$15,000. Ohio. W-8266.

Assistant Export Manager, 27–40, experience in application engineering, preferably in fields of pneumatics and hydraulics. Fluency in German necessary. Salary open. Some travel abroad. Conn. W-8261.

Industrial Engineer, degree in industrial engineering, six years' practical experience including time and motion-study theory, process-engineering theory, and practical experience with manufacturing-facility layout, methods, jigs, and fixtures, general tooling, and cost estimating for manufacturer of doors, furniture, etc. $10,000–$12,000. Midwest. W-8260.

Pump-Application Specialist, 25–35, graduate mechanical preferred, experience in centrifugal-pump application and particularly in refinery and process-pump application. Working knowledge of hydraulics. Will receive and analyze, pump inquiries from field-sales offices and customers; prepare quotations; write technical and analytical letters to field offices and to customer. To $8000. East. W-8248.

Design and Engineering Manager, Metal-Curtain-Wall Field; must have experience in the curtain-wall field; experience with the design aspects and, preferably, should be the designer. Duties will include all engineering work in connection with metal-curtain walls from the point of introducing designs to architects through production; will supervise development of standard as well as custom-made curtain-wall installations. Base salary, $9000–$12,000, with liberal bonus. Ohio. W-8240.

Marketing Manager, Mechanical Construction, background in the industry and contacts with contractors, architects, engineers, knowledge of marketing techniques in the industry and top-caliber sales ability. Must have made "big ticket" sales of million-dollar volume. Must be adept at motivation of salesmen and planning of programs as well as in the analysis of the market. Will report to vice-president and be responsible for sales and marketing programs, their development, execution, and evaluation. From $15,000, large bonus potential. Pa. W-8238.

Product Manager for a manufacturer of electric call, signal, and alarm systems, 35–45, thorough knowledge based upon experience of the national market for sound and co-ordinated signal distribution systems. Familiarity with design and production problems and costs. Will investigate and appraise market potential; collaborate with sales and research and development on design of systems and introduction into field, etc. $12,000–$15,000, fringe benefits. East. W-8233.

Vice-President, Manufacturing, for a small precision metal manufacturing company; graduate mechanical preferred; proved manager with a good knowledge of engineering, production planning and control, purchasing, quality control etc. Recent experience as head of manufacturing, as works manager, plant superintendent or chief of industrial engineering, quality-control manager, etc., with a small manufacturer of mechanical, metal-measuring instruments, gages, small machine tools, etc. desirable. $20,000–$25,000 to start, plus incentive. New York State. W-8226.

Maintenance Engineer, Paper Mill, 30–45, BSME or BSEE, ten years in the paper industry or an allied field, for design, development, and maintenance of pulp-preparation equipment, paper machines, and paper-converting machines. $10,000. Central N. J. W-8206(*a*).

Plant Superintendent, engineering degree, minimum of ten years' supervisory experience, thorough knowledge of fabrication, machining, drawing interpretations, and management techniques. Working knowledge of industrial-engineering production control and union-contract administration. Three to four years minimum experience in steel-fabrication operations. Salary open. New York State. W-8171.

Senior Engineer, Applied Mechanics, recent graduate MS or PhD, or several years' experience. Analytical ability desired. Position with small consulting firm doing business in wide variety of fields, including missile and submarine-vibration problems. Open. Relocation costs paid. Mass. W-8149.

Mechanical Engineers. (*a*) Mechanical graduate, up to four years' experience in medium-heavy machinery design or development in field of solids-liquid centrifuging and filtration. (*b*) Mechanical graduate, at least five years' mill or equipment manufacturing and design experience, for pulp and paper preparation, machinery design, and application engineering. Will be assistant to division engineer. Duties will include application engineering on pulp and paper screens and cyclone separators, lab. and field testing or equipment, supervision of machine design, etc. Mass. W-7577.

Chicago Office

Design and Development Engineer, graduate mechanical, to 40, at least three years' experience in design and development, for design and development of industrial valves for petroleum and chemical and process industries. Should have sales ability and design to customers' specifications. Must be U. S. citizen. $7000–$10,000. Employer pays placement fee. Ky. C-7800.

Sales Trainee, graduate mechanical or chemical, to 30, to run chemical tests in company's filtration lab. This will be followed by various field trips to gain first-hand knowledge of customer's filtration problems. After a year or two should be able to be assigned to permanent sales and service duties. $6000–$7000 a year. Employer pays placement fee. Ill. C-7823.

Research and Development Engineers, mechanical and civil, MS and PhD; with no experience to considerable experience in one of the following: Experimental stress analysis; soils dynamics to work on research programs in the areas of wave propagation in soils, soils properties, and soils structures; experimental hydrodynamics; analytical mechanisms and stress analysis; thrust on rockets, ballistics, and case design; rocket technology, aerodynamic heating; thermal radiation, heat-transfer in reactor design and solar energy, for a research organization. $6600–$10,800. Employer wil' pay placement fee. Ill. C-7812(c).

Assistant Plant Engineer, degree in engineering or equivalent, 35–45; five years' experience supervising plant maintenance, operation of boilers and utilities, and machine-tool repair and maintenance; knowledge of preventive maintenance programs. Duties will include general supervision of maintenance departments in two plants; preventive maintenance; planning and scheduling of major repairs on machinery, equipment, buildings, and material-handling equipment, for a manufacturer of motorcycles. $7800–$9000. Employer will pay placement fee. Wis. C-7803.

San Francisco Office

Junior or Intermediate Designer, ME, young, qualified to provide assistance in development and test of small and medium-sized products made of sheet steel plus plastics or synthetics; to satisfy clients' needs. For a manufacturer. $6000–$6600 up. San Francisco Peninsula. Sj-4893-R.

Sales Engineer, some mechanical training and sales experience preferred, about 30. Sales, some take-off from blueprints of heating and ventilating supplies, louvers, vibration-elimination equipment; contact heating, ventilating, sheet-metal trades, mechanical contractors, engineers. Commission, but will guarantee salary to start. For manufacturers' representative. N. Calif. Discuss payment of placement fee with employer. Car required. Sj-4877.

Mechanical Engineer, BSME, three to five years' experience in process industry involving both fluid and solids movement. Prefer experience in vegetable-oil-manufacturing industry using both expeller and solvent-process extraction. Assignments in design, layout, and follow through from minor projects to large installations. San Francisco. $7200. Sj-4846.

Electromechanical Designer, ME, Topnotch creative designers for small precision elements in electromechanical consumer device to develop concepts and ideas into practical manufacturing form. For medium-sized manufacturer. Local and regional men only. $12,000. San Francisco Peninsula. Sj-4795-R.

Maintenance Engineer, ME, 25–30. About seven years' experience preferred in plant engineering and maintenance of pulp and paper-process equipment, machinery and plant, or closely related. For paper-board manufacturer. Salary commensurate. San Francisco East Bay. Sj-4880-R.

Installation Engineer, ME, young. Qualified by experience and training to work with sales department and on installation, service, and advisory assistance of liquid sugar equipment installed in user premises. Must be able to determine physical layout and appropriate size of tanks, valves, and pipes; also prepare layout drawings and supervise mechanics in installation. For manufacturer of liquid sugar. $7200–$10,800. San Francisco Bay area. Sj-4876.

Designer, young experienced or recent graduate from accredited school, with interest in mechanical design, for shop machinery. Will train if necessary. Salary open. San Francisco. Sj-4878-R.

Inside Sales Engineer, mechanical background. Able to handle an inside sales desk for a small concern manufacturing pumps. Will be required to become familiar with catalog, standard items, pricing of accessories and modifications, and able to prepare job orders for machining and assembly of pumps. About $5400. San Francisco. Sj-4875.

Engineers, (*a*) Designer, ME, to 55. Minimum two years' experience mechanical and structural design, preferaby in cement; will layout, design and estimate for crushing, screening, conveying and other cement equipment and structures. $7200 up. (*b*) Process engineer, ChE or ME, 28–40. Minimum three or four years' experience in cement or similar work, knowledge of factory and understanding of instrumentation. Will work as process engineer developing improved processes in connection with operating personnel. For cement company. $7200 up. Central Calif. Coast. Sj-4869.

Staff Plant Engineer, ME, in 30's. Ten years' experience plant and equipment maintenance, machinery arrangements, preventive and repair work on machinery, equipment, buildings, trucks, machine shop. Must be able to layout design, draft and supervise others in four-plant operation including growing, picking, processes, canning, fertilizer reduction, trucks maintenance, machine shop operation for maintenance purposes, some light shop work on prefabricated buildings. For food-growing and processing company. $7800, plus personal car. Santa Cruz County. Sj-4862.

Master Mechanic ME, under 45, several years' experience in operating and supervising plant maintenance programs including or related to copper concentrators, crushers, grinding mills, pumps, conveyers, fans, etc. Electrical, mechanical, and civil for copper ore milling. Salary open. Southwest. Sj-4857.

Operating Engineer, ME or EE, 30–37, supervisory ability as well as power-plant experience on systems about 200 mw, will send out of one billion kwh. For a utility. $9600–$10,000. Southwestern U. S. Sj-4855.

Assistant Professor, MS, under 45. Experienced in teaching and/or industrial desirable; will teach undergraduate courses in thermodynamic heat, power, heat transfer. Start September, 1960. Salary open. San Joaquin Valley. Sj-4848.

Mechanical Engineer, age open, well experienced in design of heavy machinery and equipment for operating chemical plant. Will be concerned with design of new, revised, and revamped equipment and installation. Position is chief engineer. Salary commensurate. Northern San Joaquin Valley. Sj-4758.

CANDIDATES FOR MEMBERSHIP AND TRANSFER IN ASME

The application of each of the candidates listed below is to be voted on after Jan. 25, 1960, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

New Applications and Transfers

Alabama

Lyons, Donald E. A., Birmingham

Arizona

Wahl, Frank E., Phoenix

California

Brown, Fayette, Chico
Brush, Birchard M., Los Angeles
Christensen, John F., Whittier
DeYoung, Theodore L., Folsom
Farrel, Edgar C., Sacramento
Feldmann, Albert A., Culver City
●Galletly, Gerard D., Sausalito
Houdyshel, James A., Anaheim
Magura, Milton J., San Francisco
Martin, John K., San Francisco
McNeil, Daniel B., Los Angeles
Mills, George R., San Pedro
Volz, William A., Sunnyvale
Wistort, Robert A., Castro Valley

Colorado

●Mattson, Henry, Denver

Connecticut

Calka, John F., Springdale
Hinman, William A., Jr., Cheshire

District of Columbia

Harland, Anthony B., Washington

Delaware

Fowler, Curtis W., Wilmington

Illinois

Berger, Alvin J., Chicago
Fritch, Gwynne S., Palos Heights
●Kolflat, Tor, Chicago
Mitchell, Richard J., Wheaton
Shanks, David L., Evanston
●Sheehan, Jack J., Chicago
Vandenbroucke, Lester C., Brookfield

Indiana

Cottingham, Willian B., Lafayette
Haller, Roland, Columbus
Wagert, Warren J., Indianapolis
Westerfield, Hugh F., Fort Wayne

Kansas

DesJardins, Richard J., Jr., Prairie Village

Louisiana

●Burke, Richard J., New Orleans

Maryland

Bodnar, George T., Silver Springs
John, James E. A., Hyattsville
●Pasman, Jay S., Baltimore
Rogers, Frank A., Bel Air
Tilgner, Ralph F., Ellicott City
Vlcke, Joseph F., Annapolis

Massachusetts

Dahl, Norman C., Cambridge
Trefethen, Lloyd M. G., Medford
Wetzell, Howard B., Brockton

Michigan

●Mueller, Wayne H., Owosso
Trask, Donald C., Jackson
Vaughn, Jesse G., Detroit

Minnesota

Daugherty, Roland H., Rosemount

Missouri

Atwell, Lawrence N., Kansas City
Brown, Robert D., Columbia
Geil, Warren C., St. Louis
●Leonard, Byron, H., Jr., Clayton
Robinson, Thomas B., Kansas City

New Jersey

Blackman, William, Haddonfield
Engel, Edward G., Westfield
Jorgensen, Fred H., Fort Lee
Kregg, David H., Chatham
Lenehan, Joseph W., New Brunswick

New Mexico

Dixon, Donald E., Grants

New York

Arthurs, Marvin J., New York
Bassett, Robert W., Johnson City
Bellware, Morris D., New York
Bukulmez, Salih, Olean
Dautel, John D., Syosset
●Diehl, Conrad, Rochester
Dimenna, Ralph L., Wappingers Falls
Jewson, Stanislaus, Beacon
Kennedy, John J., Johnson City
Maurer, Ralph C., New York
Mersereau, Everard C., New York
Mortman, Irwin, Schenectady
●Schneiderman, Abraham, Westbury
Snyder, Francis T., Niagara Falls
Treubert, Werner R., E. Meadow
●Yu, Yi-Yuan, Brooklyn
Wang, Edward D., Syracuse

North Carolina

●Crotts, Marcus B., Winston-Salem
●White, Neal W., Hendersonville

Ohio

Blakeman, Earle C., Cleveland
Khalaf, Farouk D., Barberton
Lieblein, Seymour, Fairview Park
●Moskoff, Micheal C., Euclid
●Shimp, George E., Lyndhurst
Skaff, George S., Toledo
Vitez, George A., Akron

Oklahoma

Reynolds, Lewis J., Jr., Oklahoma City

Pennsylvania

Abrams, Raymond, Allentown
Bodden, Hugh E., Middletown
●Crossey, Michael A., McKees Rocks
Gibbons, Thomas P., Havertown
McMackin, Carl A., Palmerton
Olear, Philip, Bethlehem
●Powell, George W., 3rd, Darby
Sinwell, Bernard R., Westmoreland
Styer, Robert F., Springfield

● Transfer to Member or Affiliate.

Tennessee
Enloe, Roland L., Chattanooga
Jenkins, Charles M., Chattanooga
Williamson, Carl P., Chattanooga

Texas
Ferguson, Tyler A., Houston
Hull, Richard D., Houston
Lancaster, Billy J., Dallas
Martin, Herschel M., Jr., Houston
Rajagopalan, T. C., College Station

Vermont
Carpenter, Howard J., Burlington

Virginia
Davis, Kenneth A., Falls Church

Washington
●Diediker, Donald M., Richland

Wisconsin
Rewey, William M., Madison

Foreign
Bellingham, Allen, Edmonton, Alta, Canada
Benaroya, Alfred, São Paulo, Brazil
Coghlan, Arthur J., Sydney, Australia
●Kjemtrup, Jens E. F., Herler, Denmark
Smith, Roderick C. S., Manchester, England
Sondhi, Kuldip R., Mombasa, Kenya, Br. E. Africa
Thompson, Raymond V., Hertfordshire, England

OBITUARIES

Calvin Dodge Albert (1876–1959), professor emeritus of machine design, Cornell University, Ithaca, N. Y., died Sept. 23, 1959. Born, White Haven, Pa., Nov. 17, 1876. Parents, Frank H. and Ella (Wood) Albert. Education, ME, Cornell Univ., 1902. Married Claudia Louise Agnew, 1905 (d. 1945). Mem. ASME, 1911. From 1919 until his retirement in 1944, Professor Albert was in charge of the Department of machine design at Cornell's Sibley College. During World War I he was with the U. S. Shipping Board, Emergency Fleet Corp., Middle Atlantic District. He was coauthor of "Kinematics of Machinery," published in 1931. In 1948 the fourth edition of his book "Machine Design Drawing Room Problems," was published. The edition was published in revised form in 1951. He was a member also of AGMA. Professor Albert is survived by two nieces, Mrs. Olin S. Oberrender and Mrs. Harold E. Sims, both of Freeland, Pa.

William Elon Crawford (1889–1958), whose death on Oct. 22, 1958, was only recently reported to the Society, had been retired; and was formerly director of research and engineering, A. O. Smith Corp., Milwaukee, Wis. Born, Big Rapids, Mich., Aug. 21, 1889. Parents, David A. and Cora A. Crawford. Education, BS(EE), Univ. of Michigan, 1914. Married Bertha Satterly, 1913. Mem. ASME, 1947. Mr. Crawford joined A. O. Smith in 1920. He held 19 patents pertaining to welding and welding apparatus. He was the author of a paper, "Inventions, Patents, and the Engineer," published in *Electrical Engineering;* and of a section of the 1938 "Welding Handbook." He was a member also of NSPE and a Fellow of AIEE. Registered professional engineer in the State of Wisconsin. Survived by his widow.

Robert Ames Cross (1888–1958), administrative assistant to chief engineer, Deere & Co., Moline, Ill., died Aug. 13, 1958, according to a notice received by the Society. Born, Bureau, Ill., Dec. 13, 1888. Parents, Hubbard Ransom and Angeline Martha (Henning) Cross. Education, high-school graduate; two years special study, Intermountain Institute. Married Gladys Hixson, 1911. Assoc. Mem. ASME, 1921; Mem. ASME, 1935. Mr. Cross had been with the firm which manufactured agricultural implements since 1926. He served the Society in local section committee work. Survived by his widow.

Arthur Charles Eckert (1886–1959), retired patent attorney, Chesterfield, Mo., died May 14, 1959. Born St. Louis, Mo., Dec. 7, 1886. Parents, Chas. A. and Adele M. Eckert. Education, BS, Washington Univ., 1910; BS(ME), 1912; LLB, 1913. Married Gertrude Wunderlich, 1915. Assoc. Mem. ASME, 1913; Mem. ASME, 1919. Mr. Eckert had prosecuted hundreds of patent applications in the U. S. patent office and had been counsel in patent litigation throughout the U. S. He was a member of the bar, U. S. Supreme Court, Missouri Supreme Court, Districts (Federal), and U. S. Courts of Appeals in different circuits.

Raymond Dietrich Foltz (1895–1959?), whose death recently was reported to the Society, had been a director and former president of M. H. Detrick Co., Chicago, Ill. Born, St. Joseph, Mich., June 24, 1895. Parents, Chas. W. and Mary A. Foltz. Education, BS(ME), Univ. of Michigan, 1917. Married June Whipple; two sons, John W. and Thomas R. Foltz. Mr. Foltz held six patents pertaining to stoker and furnace construction. He joined M. H. Detrick in 1919 after having served a year in the U. S. Navy. Junior ASME, 1921; Assoc-Mem. ASME, 1925; Mem. ASME, 1935.

James Page Harbeson, Jr. (1889–1959), retired, formerly chief engineer, Camden Forge Co., Camden, N. J., died April 20, 1959. Born, Philadelphia, Pa., Nov. 8, 1889. Parents, James Page and Frederika (Krauter) Harbeson. Education, completed three-year course in mechanical engineering, Univ. of Pennsylvania. Married Helen Frances Moore, 1912. Assoc. Mem. ASME, 1918; Mem ASME, 1935. Mr. Harbeson had been with Camden Forge Co. from 1915 until his retirement. He had been in complete charge of all engineering there covering design of special machinery, powerhouse operation, and all maintenance. He served the Society as chairman of the Philadelphia Section, 1936–1937. Survived by his widow and two sons.

Harry Dwight Hartley (1881–1959), retired executive, Indianapolis, Ind., died Aug. 26, 1959. Born, Bluffton, Ind., Dec. 25, 1881. Parents, George and Lydia Hartley. Education, BS, Purdue Univ., 1903; ME, 1906. Married Hazel Stewart, 1923. Junior ASME, 1910; Assoc. Mem. ASME, 1921; Mem. ASME, 1934. Mr. Hartley had been president of the Pioneer Coal & Shaft Co., president of the Piqua Savings Bank, and president of Turner Glass Co. of Indianapolis. He retired in 1930. Interested in forestry, Mr. Hartley served at one time as consultant to the U. S. government forestry division. During World War I, he was a member of the War Industries Board and in World War II he served on the war rationing board. Survived by his widow, Hazel Steward Hartley; and a daughter, Mrs. Frederick Anderson.

Frederick George Hughes (1878–1959), a retired vice-president of the General Motors Corp., died Oct. 3, 1959, in Bristol, Conn. Born, West Cornwall, Conn., May 1, 1878. Parents, George and Mary (Volmiller) Hughes. Education PhB, Sheffield Scientific School, Yale Univ., 1900. Married Edith Crawford 1905. Mem. ASME, 1913. Mr Hughes at his retirement in 1947 was a vice-president of General Motors and general manager of its New Departure Div., the section that produced ball bearings. He joined New Departure in 1911 as chief engineer, became production manager in 1914, assistant general manager in 1919, and division head in 1934. During World War I, he headed a commission that co-ordinated the efforts of the ball-bearing industry, and in World War II he was on the War Production Board's advisory committee for the antifriction-bearing industry. He held about 50 patents. In community affairs he served as director of the Connecticut Chamber of Commerce, chairman of the board of the North Side Bank & Trust Co., and chairman of the executive committee of Bristol Hospital. In 1940 he was the recipient of the Modern Pioneer Award of the NAM. He was a member also of SAE and a past-president of ASM. Survived by his widow; and a daughter, Mrs. Madlyn Wesley.

Burton Elias Hull (1884–1958), whose death on Nov. 7, 1958, was recently reported to the Society, was the builder of the Big Inch and Little Inch pipelines and the famous Tapline in the Middle East. Born, Navasota, Texas, May 23, 1884. Parents, Chas. Edw. and Lida (South) Hull. Education, BS(CE), Texas A&M, 1904; hon. PhD, 1950. Married Ruth Moser, 1914. Mem. ASME, 1916. Mr. Hull was vice-president of Texaco, president of The Texas Pipe Line Co., and president of Trans-Arabian Pipe Line Co., a Texaco affiliate. The Big Inch, from East Texas fields to the Linden (N. J.) refining center, was the first crude line to use pipe as large as 24 in. Construction of the Big Inch, and the 20-in. Little Big Inch products line from the Gulf Coast to the East Coast were remarkable feats in themselves, but they were made more outstanding by the additional wartime obstacles. With the Inch lines completed, he left to build Trans-Arabian from Saudi Arabia's Persian Gulf fields to Sidon, Lebanon, on the Mediterranean, the first 30-in. line to transport crude oil. He retired in 1951, although he continued as a pipeline consultant. He was a charter member of the American Petroleum Institute, and a member of Tau Beta Pi. Survived by his widow; his mother; a son, Burton E. Hull; and a daughter, Ruth Margaret Hull.

Alfons Georg Loeffler (1897–1959), project engineer, Remington Rand Univac Div., Sperry-Rand Corp., South Norwalk, Conn., died Sept. 12, 1959. Born, Wuerzburg, Germany, July 8, 1897. Education, diploma ME, 1924; diploma EE, 1925. Naturalized U. S. citizen. Mem. ASME, 1945. Prior to joining Sperry-Rand, Mr. Loeffler had been chief engineer with Allen Billmyre Co. Survived by his widow, two sons, and a daughter.

George Alexander Long (1870–1958), retired, inventor and at one time general manager, The Gray Telephone Pay Station Co., Hartford, Conn., died Nov. 20, 1958, according to a notice only recently received by the Society. Born, Montreal, Canada, Nov. 3, 1870. Education, common schools. Mem. ASME, 1914. Mr. Long held over 27 patents.

William John Lueckel (1890–1959), retired, New York representative, Logan Co. & Merrick Scale Manufacturing Co., New York, N. Y., died Aug. 31, 1959. Born, East Orange, N. J., Aug. 6, 1890. Parents, August and Madeleine (Dillenius) Lueckel. Education, BS(ME), Cooper Union, 1916. Married Alice E. Collins, 1948. Mem. ASME, 1928. Mr. Lueckel was a specialist in the field of conveying machinery. Survived by his widow; and one son, Wm. J. Lueckel, Jr., Glastonbury, Conn.

Harry J. Marks (1870–1959), sales engineer, Erie City Iron Works, New York, N. Y., died Oct. 15, 1959. Born, London, England, Jan. 4, 1870. Education, private tutors and correspondence school. Married Gladys L. Brown. Mem. ASME, 1907. Mr. Marks was a specialist in the design and construction of power plants. Survived by his widow.

Edward Coverly Newcomb (1872–1959), whose death recently was reported to the Society, had been retired in North Scituate, Mass. Born, Scituate, Mass., Sept. 3, 1872. Education, common schools. Mem. ASME, 1913. Mr. Newcomb was a specialist in the field of internal-combustion engines, carburetors, and ignitions. Survived by a daughter, Mrs. M. Newcomb Swift.

Norman Trygve Olsen (1906–1958), president, Peerless Equipment Co., Chicago, Ill., died in November, 1958. Born, Chicago, Ill., Dec. 6, 1906. Parents, Nels C. and Minnie T. Olsen. Education, Armour School of Engineering. Married Elsa C. Person, 1927; one daughter, Corinne. Mem. ASME, 1946. Prior to joining Peerless in 1951, he had been with the Chicago & North Western Railway since 1923. Mr. Olsen had been a registered professional engineer in the State of Illinois. He was a member also of the Society for Experimental Stress Analysis.

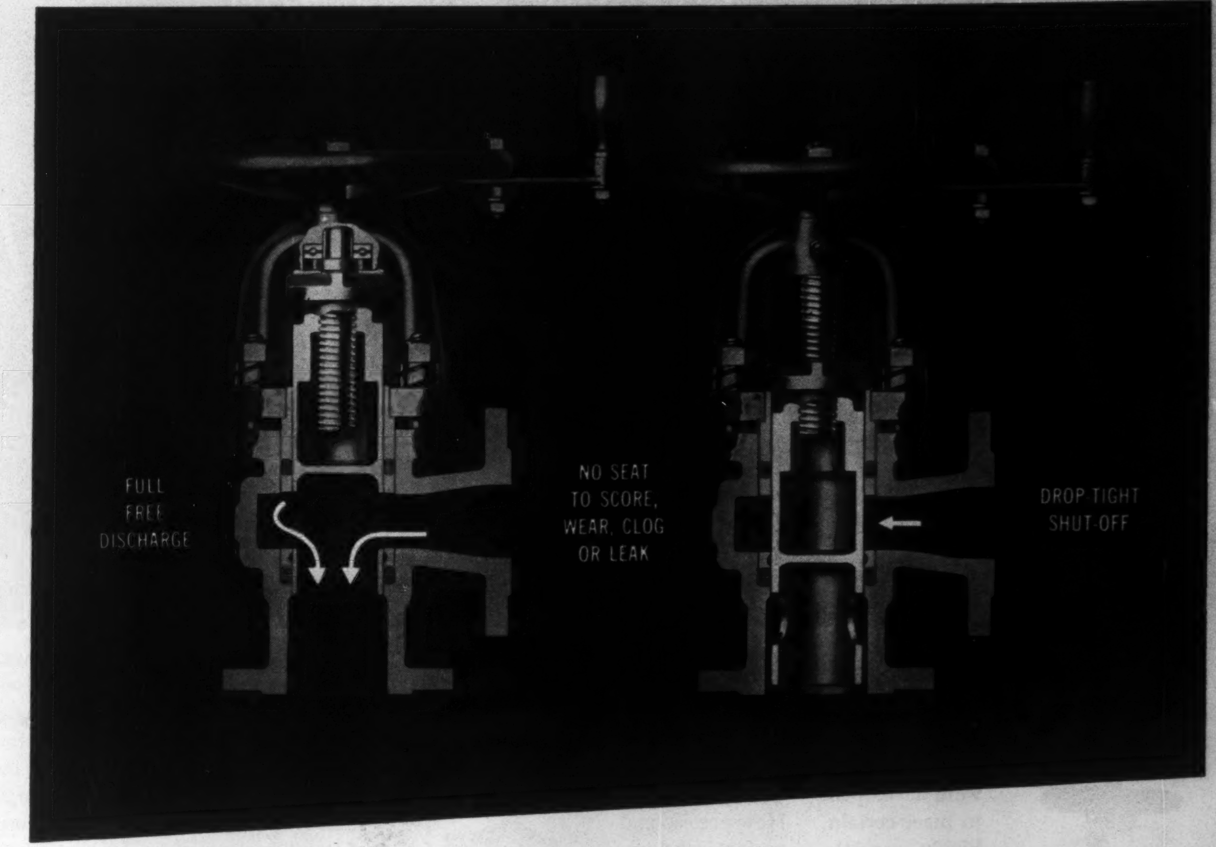
Henry Terry Purdy (1866–1959?), whose death recently was reported to the Society, had been manager, H. T. Purdy, Inc., San Jose, Costa Rica, C. A. Born, Brooklyn, New York, Feb. 22, 1866. Education, public schools. Mem. ASME, 1909. Mr. Purdy formed Purdy Engineering a firm which designed and constructed transmission lines for Costa Rica Electric Light and Traction Co., the Abangarez Gold Fields, and the Aguacate Mines.

Robert Rennie (1868–1959), retired test engineer for the American Locomotive Co., New York, N. Y., died Oct. 12, 1959. Born, Lodi, N. J., March 24, 1868. Education, Stevens School. Mem. ASME, 1922. Mr. Rennie had been with the Locomotive company from 1924 to his retirement in 1946. Surviving are a son, Capt. Robt. G. Rennie; four daughters, Mrs. James R. Sutphen, Mrs. Emile Gruppe, Mrs. Howard Shannon, and Mrs. Louis B. Franklin.

Herman J. Scharnagel (1886–1959?), whose death recently was reported to the Society, has been retired. Born, Brooklyn, New York, Jan. 23, 1886. Education, Brooklyn Polytechnic Institute. Mem. ASME, 1919. Mr. Scharnagel was a specialist in the field of design and construction of internal-combustion engines particularly diesels. His early experience in the field was gained at the Brooklyn Navy Yard and the Sperry Gyroscope Co.

Phillip Aderzuch Udall (1884–1959), president, Udall & Landan Mfg. Co., Inc., died Oct. 10, 1959. Born, Riga, Russia, Oct. 18, 1884. Parents, Bernard and Dnasia (Aderzuch) Udall. Education, technical schools in Russia, and ICS. Naturalized U. S. citizen, San Francisco, Calif., Feb. 11, 1916. Married Winifred Epstein, 1911. Mem. ASME, 1939. Mr. Udall held numerous patents particularly a high-speed printing press, a valve-grinding machine, and a fluid-drive assembly for automobiles. His five-acre model of the Panama Canal, built at a cost of $500,000 for display at the 1915 Panama-Pacific International Exposition in San Francisco was awarded a Gold Medal. Survived by two sons, Frederick M. and William Udall.

Kung-Chih Wang (1921-1959), development engineer, Divisional Development Laboratories, U. S. Rubber Co., Mishawaka, Ind., died Sept. 3, 1959. Born, Manchuria, China, Oct. 20, 1921. Education, BS(ME), Brown Univ., 1943; SM, Mass. Inst. of Tech., 1945. Naturalized U. S. citizen. Assoc. Mem. ASME, 1951. Mr. Wang had been with U. S. Rubber since 1951. Survived by his widow, Joan Wang, and two children.



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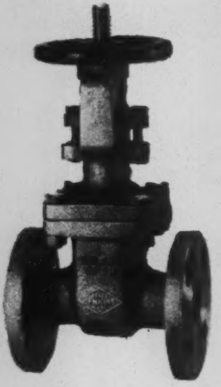

Most of the alloy specs were developed to meet certain highly specialized and rather uncommon needs. Only 1 out of 100 valve users can make practical use of many of the alloys. *Actually, just two or three of the different available alloys will give a big majority of valve users all they want and need.*

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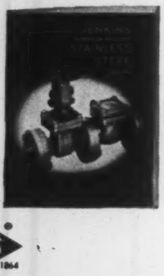

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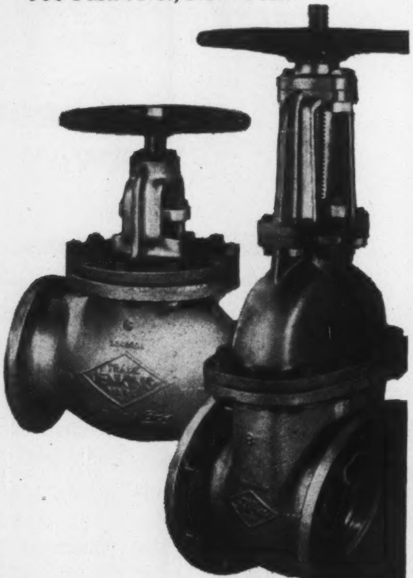

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NEW EQUIPMENT

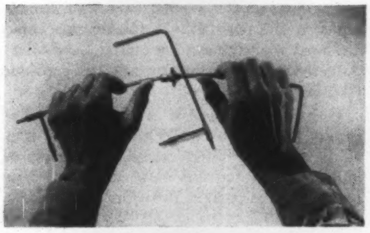
Pneumatic Grinders

An eight-in. model has been added to its line of portable pneumatic grinders by Thomas C. Wilson, Inc.

The new 905 series consists of heavy duty horizontal grinders, wire brushing machines, and horizontal buffers suitable for up to 8-in. wheels.

Machines in the 905 series offer a choice of four free speeds: 6000, 4500, 4100 and 3100 rpm. Straight, lever, or grip-type handles may be specified.

Features cited by the company include lightweight one-piece aluminum housing construction; one-piece hardened and ground spindle; four prelubricated and sealed spindle bearings; steel inserts in all housing threaded holes and bearing bores; and hardened, ground, and honed cylinder. **—K-1**



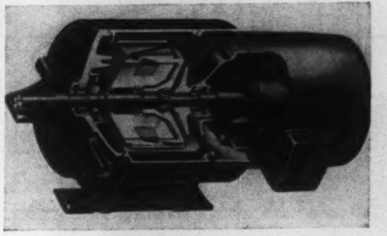
Steel Pitot Tubes

F. W. Dwyer Mfg. Co., offers a new series of pocket-size tubes fabricated from hypodermic-needle grade stainless steel.

With an od of only 1/8 in. and overall lengths of 6 or 12 in, the new tubes are small enough to fit easily into standard pocket size gage cases.

Because of the spring-like quality of the stainless steel used, the tubes may be flexed without damage, and may be used in temperatures up to 800 F.

All joints are silver soldered and special extreme temperature types are available on special order. The hemispherical tip is almost impossible to damage and static openings are carefully machined for maximum accuracy, the firm reports. **—K-2**



Adjustable Drive

A new, low-cost line of eddy current coupling adjustable speed drives from 5 to 100 hp has been announced by General Electric Co.

The firm says the new Kinatrol line is engineered for a broad range of industrial applications and features simplified design with fewer moving parts for longer service life and sharply reduced maintenance.

The drive is being offered as a complete package including the drive unit, control enclosure with control for both coupling and integrally mounted Tri-Clad 55 a-c motor, and operator's station.

Ratings through 20 hp are capable of continuous operation down to 100 rpm at rated torque providing a speed range of approximately 17:1.

Automatic control provides close speed regulation as standard. On a typical friction type load, the company says, regulation of two per cent of full speed can be obtained with standard equipment.

All ratings are in horsepower delivered at output shaft of coupling, rather than at output shaft of a-c motor. **—K-3**

Hollow Cone Nozzle

Spraying Systems Co. has announced a patented new design WhirlJet spray nozzle for applications where liquids containing mildly abrasive particles are sprayed.

The firm says the internal contour of the nozzle makes use of a fundamentally new hydraulic design principle and it is this new type of internal contour that is responsible for the nozzle's greater resistance to abrasion. The nozzle produces a hollow cone spray pattern with uniform distribution and uniform circular shape.

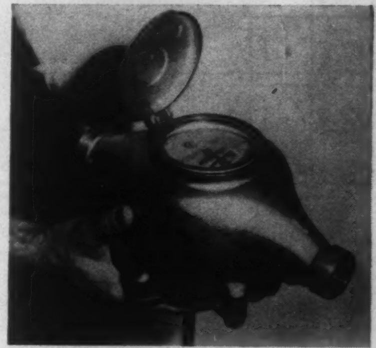
The new nozzles are identified as the Type AX and BX nozzles and are supplied in a choice of brass, steel and 303 stainless steel. A range of capacities are offered in 1/8, 1/4 and 3/8 in. female or male pipe connection sizes. **—K-4**

Control Instrument

A compact package instrument for controlling process pressures or temperatures now is available with several important refinements from Fulton Sylphon Div. Robertshaw-Fulton Controls Co.

The unit, a controller-positioner-valve, is available with an automatic reset feature. The pneumatically operated instrument is said to combine in a single package unit the features of measurement, control point setting, modulating control, adjustable proportional band, positive valve positioner, and control valve.

When used as a control valve (having positive positioner) with various pneumatic transmitters, it can control variables such as rate of flow, liquid level, or temperatures and pressures beyond the range of its own vapor-pressure temperature elements or bellows pressure elements, the firm reports. **—K-5**



Water Meter

A new larger-capacity magnetic drive sealed register water meter has been introduced by Rockwell Mfg. Co.

The new 1-in. model has a capacity of 50 gpm compared with capacities of 20 and 30 gpm respectively for 5/8 and 3/4 in. models.

The company says special features are a hermetically sealed register to end the problem of dirt, water, and condensation that fogs dials, a powerful magnetic drive which eliminates the need for a stuffing box, an exposed intermediate train and a driving dog, and the proven oscillating piston principle for long life and accurate measurement.

The entire unit contains 15 stock parts, of which two moving parts operate in contact with water. **—K-6**

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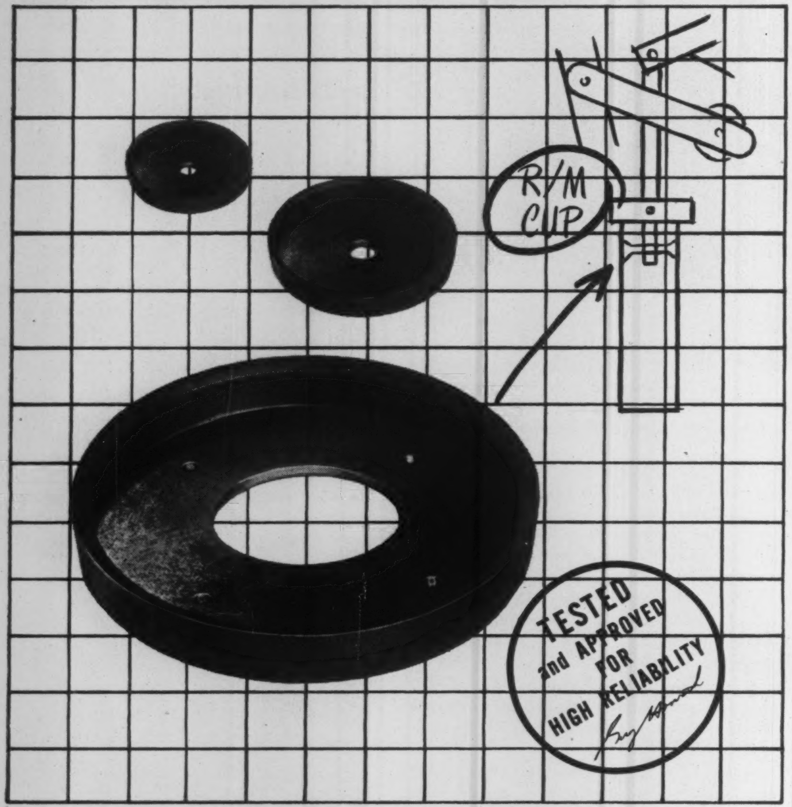

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Motor Pulley

Worthington Corp. has announced introduction of its variable speed drive motor pulley in sizes 1 to 15 hp.

The pulley features an all area greasing system, with free distribution of grease to bearing points, a single lubrication point on the end of the pulley, and an exclusive grease reservoir. The unit is designed with a simple single moveable flange and totally enclosed separate spring cartridges.

The pulley can be mounted on the firm's angle-matic motor base, which is designed to maintain proper belt tension through the entire range of speed change. It also uses the firm's variable speed belt and the QD companion sheave with separate hub and V-groove rim in its operation. **—K-7**

Packaged Demineralizer

A new packaged demineralizer designed for quick installation has been developed by Cochrane Corp.

On-site erection consists of setting the unit in place and connecting to air and raw water supply, treated water outlet, and open drain. Only electrical connection required is for a conductivity controller, which uses 110 v 60 cycle current from a standard lighting outlet.

Designated as the Uni-Pac M series, models of the new demineralizer are available in capacities from 2100 to 13,200 gph using raw water with 10 gpg total exchangeable anions.

The firm says operating valves and piping are corrosion-proof PVC and exchange tanks are lined with the same material. Auxiliary polyethylene regenerant tanks are provided for acid and alkali.

Units are equipped with conductivity and rate-of-flow indicators. Optional controls include totalizing water meter, audible alarm, and automatic cut-off valve to stop flow at end of service cycle. Brochure available. **—K-8**

Temperature Control

An air controlled temperature regulating system has been developed by Spence Engineering Co. to provide extremely accurate temperature control for systems subjected to wide and sudden load swings.

The company says that by an ingenious cascading of an air signal to a pressure regulator, it has been able to produce a relatively inexpensive but highly accurate temperature control system.

Control accuracy of 6 to 8 F over a 24 hr period under severe test conditions has been demonstrated by the new system. The firm reports that instantaneous load swings from 210 gpm down to 80 gpm water flow were easily handled while controlling temperature to within ± 5 deg of the set point. **—K-9**

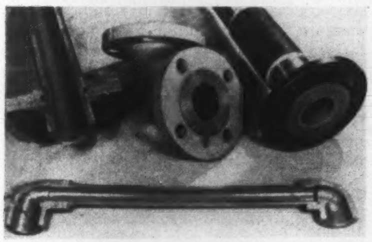
KEEP INFORMED

BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

Storage Tank Heaters

Brown Fintube Co., has developed for bulk storage tanks a new heavy duty finned tank heater designed to help overcome corrosion problems confronting plants that must use poor quality steam.

The new coils have an improved header design which provides exceptional steam distribution characteristics, excellent drainage of condensate and high corrosion allowances, the manufacturer states. —K-10



Penton Fittings

All-Penton fittings and metal fittings and pipe with injection-molded Penton-lining for handling solvents and hot corrosive fluids have been introduced by Tube Turns Plastics, Inc.,

The All-Penton assembly in foreground shows thermal-welded socket-type elbow at left and threaded connection at right. Pieces at top show alternate methods of joining lined pipe and fittings without exposing metal to corrosive fluids.

Threaded flange connection (upper left) includes plastic gasket separating carbon steel pipe ends. Lined cast-iron flanged elbow (center) has Penton raised face. Length of lined pipe at right is joined by thermal butt weld and covered by epoxy-cemented light-wall steel connecting sleeve; end piece is a lined stub end, preassembled with welded steel back-up flange. —K-11

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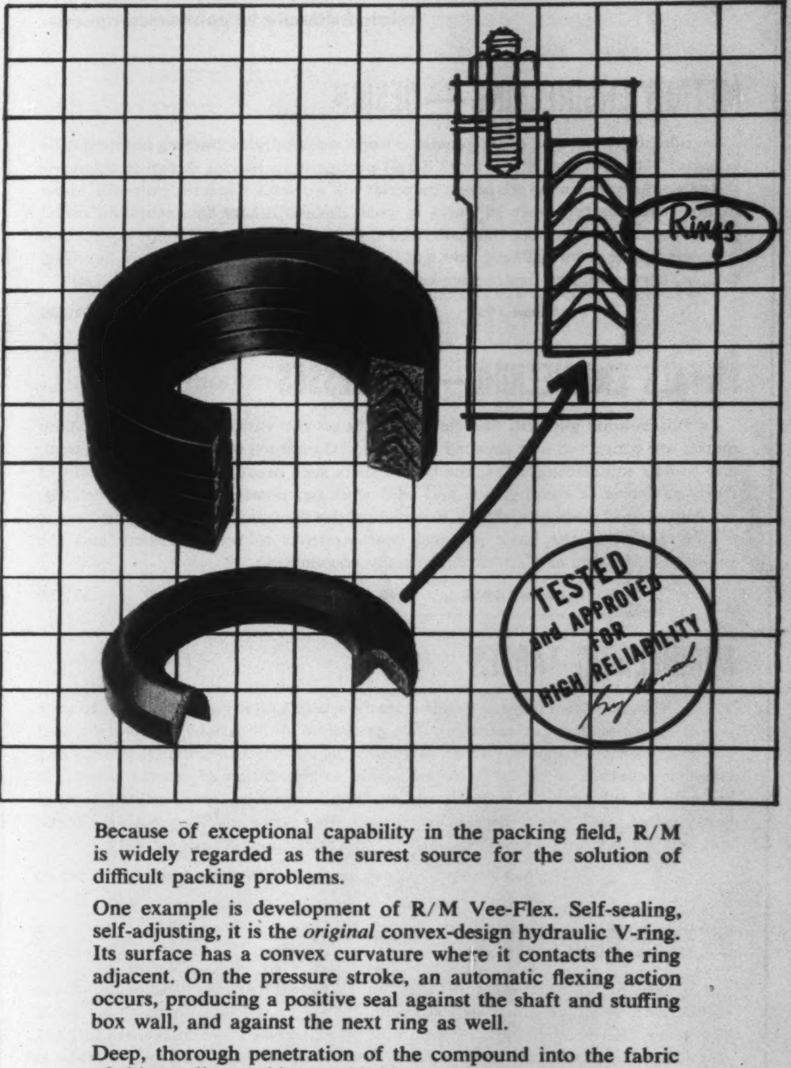
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In this volume you will find detailed data on the various processes by which metals are converted into finished products. Composed of a wealth of practical, day-to-day engineering helps, the book covers such areas as: heat treatment of steel, all forms of casting, hot and cold working, powder metallurgy, welding, machining, and electroforming. For each of the manufacturing methods there is a compilation of the basic physical characteristics to be considered, and the general advantages and limitations usually encountered.

Published 1958 448 pages 512 illustrations $13.50

ENGINEERING TABLES

This volume places in your hands a ready source of design information to save you from losing time in searching out specialized publications, periodicals, and miscellaneous data sheets. In 15 sections, this volume conveniently groups and arranges together those tables which apply to the design of specific parts. It covers such subjects as bar stock and shafting; bearings; spur, helical, herringbone, bevel, and worm gears; cylindrical fits; keys and keyseating; bolts; springs; aircraft and mechanical tubing; electrical motors, and gaskets.

Published 1956 692 pages 560 tables $12.00

METALS PROPERTIES

The specific information a designer must have about the properties of the metals with which he must work is assembled for your convenience in this book. For more than 500 metals it tabulates working data on the metallurgical, physical, fabrication, and mechanical properties of metals—such typical data as chemical composition, industrial uses, draw temperatures, tensile strength, yield point, Rockwell "C" core hardness, hot working temperature, coefficient of thermal expansion, end-quench hardenability, etc.

Published 1954 445 pages 531 illustrations $11.00

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BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

Flexible Pipe

General Rubber Corp. is manufacturing a complete line of screwed coupling flexible pipe, Type S, available in all sizes from $^3/_4$ to 3 in. diam and in standard lengths from 18 to 36 in.

The pipe is furnished with standard iron pipe threaded ends, either male-male, male-female or female-female. Special couplings can also be supplied.

The Type S line incorporates a single piece, leak-proof, oil resistant tube with the brass couplings expanded to the full inside diameter of the pipe, the firm states. All sizes are rated at 250 psig maximum working pressure, with a minimum four-to-one safety factor. The pipe is rated for a maximum temperature rating of 180F. Special tube compounds are available for higher working temperatures. **—K-12**

Motor Endshield

A new end mounting endshield for use with its Type N-1 motors is announced by the Bodine Electric Co.

The company says use of this new end mounting endshield permits ventilating air to pass into the motor without the use of separate spacers between the motor and the mounting surface. Another advantage is that the mounting surface is no larger in diameter than the body of the motor, which is not true of the conventional flange mounting shield, the firm states. **—K-13**

Single Control Valve

A patented single control valve for directing the flow of liquids in zeolite softeners, ion exchange units and filters has been introduced by Graver Water Conditioning Co.

Called the Monotrol, the valve is designed to perform the functions of a nest of individual valves while providing greater ease in operation and maintenance. It is available in cast iron or in acrylic plastic for corrosive service, and can be operated manually or automatically.

The firm says features of the valve include pilot control, positive hydraulic pressure actuation and easy maintenance. All internal moving parts can be removed for inspection and service without dismantling the connecting piping or removing the valve from the unit on which it is being used. The design provides for low pressure loss during operation and no contamination of effluent with influent, the company states.

When the pilot is set, hydraulic pressure acts to move the pistons which open and close ports in the valve body, thus allowing liquid to flow through the proper channels and accomplish the required operation. The pistons direct the flow for four basic functions: service, backwash, regeneration, and rinse (with the regeneration step omitted in filter applications). Upstream line pressure is all that is required to actuate the pistons. **—K-14**

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BUSINESS NOTES
NEW EQUIPMENT
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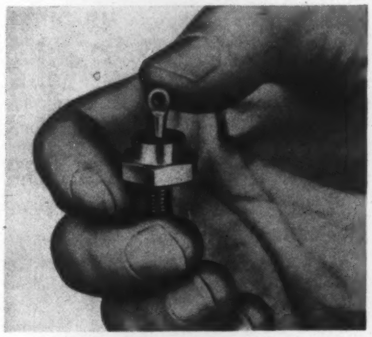
Transistorized Reactor

Bendix Aviation Corp. Announces the availability of the first 100 per cent transistorized reactor instrumentation system including source range (Startup), intermediate range (Log N), power range and magnetic switch chassis.

This circuity has been incorporated into reactor systems for the DIG destroyer; NASA at Plum Brook, Ohio; APPR at Ft. Belvoir, Virginia (test evaluation monitoring) and the University of Kansas, the company reports. Features and specifications are described in descriptive literature for the component chassis. **—K-15**



Silicon Rectifier

A new, small silicon power rectifier, Style 33, is available from Syntron Co.

The rectifier is rated at 37.5 amp average at 25 C ambient on a $5 \times 5 \times 1/16$ in. copper heat sink. Peak inverse voltages range from 50 to 400 v in 50 v steps. Temperature range is from −75 to + 175 C.

The unit is mounted on a $11/16$ in. hexagon stud base. Maximum height is $1\,5/16$ in.

A typical forward dynamic resistance of .0035 ohms is achieved by diffused junction techniques, the company states. **—K-16**

Reverse-Power Relay

A new directionally controlled timing relay (Type CRN-1) for reverse-power, three-phase applications is available from the Westinghouse Electric Corp.

The relay is rated 120 v line-to-line, five amp. The main contacts can close 30 amp at 250 v d-c and carry this current for sufficient time to trip a circuit breaker, the company reports.

Some of the features of the new relay include high sensitivity of 0.02 amp, 120 v at maximum torque, adjustable timing range from 2.0 to 40 sec, small-size Flexitest case, and low burden. The relay is completely self-contained. **—K-17**

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The largest furnace in the country producing merchant pig iron was recently placed in service as part of an expansion program by a major Southern mill. The new furnace has a rated capacity of 1000 tons per day and is one of the most modern in the country with respect to mechanization and automatic controls.

Because of their unique design and high erosive resistance, WHIRLEX heavy duty induced draft fans were chosen to handle the hot blast furnace gas. The three units shown here carry approximately 150,000 cubic feet of gas per minute. Preliminary fan examinations show wear to be less than a third that of ordinary fans designed for this purpose.

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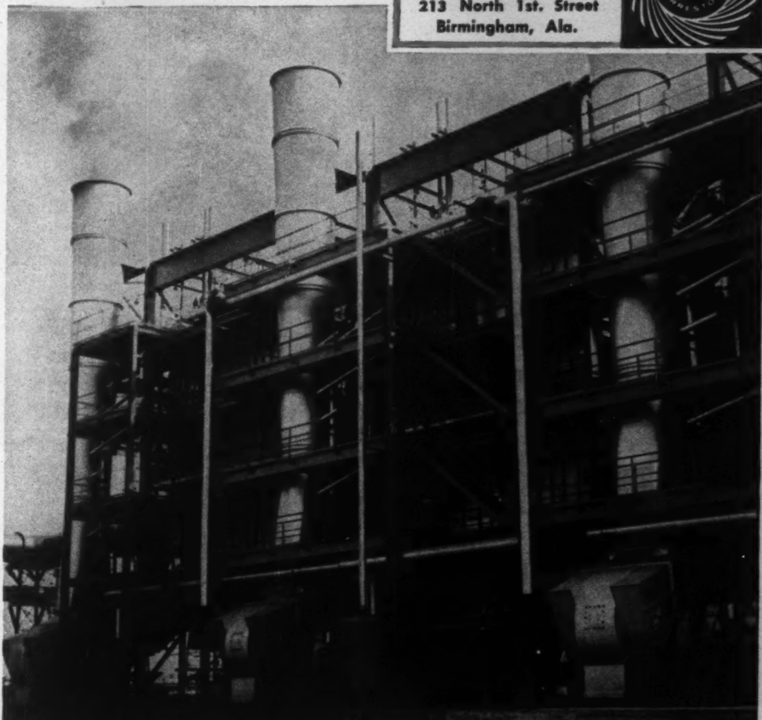

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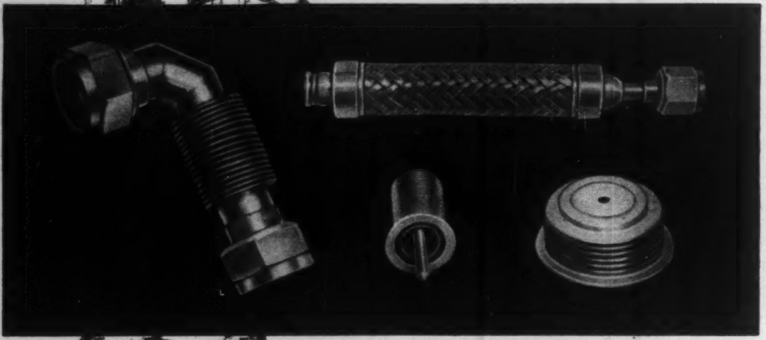

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NEW EQUIPMENT
LATEST CATALOGS

A-C Regulators

Sorensen & Co., is now offering two completely militarized versions of its electronic a-c voltage regulators.

The two new 500MIL and 1500MIL regulators are suitable for all land-based military requirements. They supply 500 or 1500 v-amp, respectively, at nominal 115 v-a-c. Output voltage regulation is ±0.5 per cent against variations in input line voltage, load, and power factor changes. Less than 5 per cent harmonic distortion is introduced by the regulator.

The regulators are supplied with 0–150 v-a-c output meters, output voltage adjustment, overcurrent breaker, and control circuit fusing. Units mount in standard 19-in. rack.

Construction and operation of the regulators is in accordance with MIL-I-4158A (USAF) for ground equipment. Most requirements of MIL-E-16400A are also met, except where these conflict with MIL-E-4158A. All electrical parts not in conformance with JNA or MIL specifications have been contractually approved by the Signal Corps, Navy, or both. Units are fungus treated with MIL-V-173 varnish. **—K-18**

Air Control Valve

A new air control valve by Hunt Valve Co. is designed so it can be replaced (including plug-in solenoid) in less than 30 sec.

Called the PDQ, the valve can be completely removed by loosening two cap screws, twisting pilot cap, removing pilot cap and valve housing, the firm reports. The valve has two replacement parts: the poppet spindle-sleeve assembly and the solenoid pilot assembly (each of which is a self-contained unit).

Weighing 4 lb, the valve is a full $^1/_2$ in. npt valve that will flow 335 cfm with 100 psig initial pressure to atmosphere, the company states. **—K-19**

Overhead Transfer

A new type of transfer for the automatic transfer from machine to machine of large parts, such as axle shafts and tanks, has been designed by Gear-O-Mation, Div. of Michigan Tool Co.

Said to be a completely new approach to the transfer process for machining, welding, and assembling operations, it operates overhead, raising the parts above the machines to index them to succeeding stations.

The basic section of the mechanism is a single box frame supported above the production line by several arch-type supports. The frame is cylinder-powered and rides on flanged guide wheels affixed to the arches.

The frame carries sets of hooks upon which ride the parts in process. Machine spindles and hook-sets are set at constant and equal intervals. Hook-sets are raised and lowered in unison by individual lift cylinders. **—K-20**

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BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

Toggle Switch

A new miniaturized two-position toggle switch designed to save space and weight has been introduced by Micro Switch, Div., Minneapolis-Honeywell Regulator Co.

The switch (designated 2TM1-T) measures $\frac{1}{2} \times \frac{1}{2}$ in. at the base and weighs $4\frac{1}{2}$ grams. Integral terminals, gold-plated stationary contacts and a high contact force give the "TM" a low circuit resistance, and dependable operation is furnished in a temperature range of −65 to plus 200 F, the company said.

Construction of the case around the contacts and other current-carrying parts is said to provide this switch with high dielectric strength. A threaded bushing with keyway slot provides single-hole mounting.

The firm says the switch is expected to find usage on aircraft panels and survival kits, geophysical equipment, printed circuit and transistorized devices, portable communication gear and other areas where space and weight are at a premium. **—K-21**

Magnet Pulleys

Indox V permanent magnet pulleys, in diameters up to 48 in., are being offered for heavy-duty tramp iron removal and cobbing applications by Stearns Magnetic Products.

Indox V, a highly oriented barium ferrite ceramic magnet material, is said to provide pulley performance equal to the most powerful electromagnetic types at much lower cost. Specifications on all pulley sizes for any conveyor system can be obtained from the company. **—K-22**

Flexible Shafts

Stow Mfg. Co. announces two new extra heavy duty power drive flexible shafts designed to transmit a great deal of rotary power over any curved path.

The S100 flexible shaft, which has 1 in. diameter core, will transmit up to 760 in-lb of torque at 600 rpm and the S125 flexible shaft, which has $1\frac{1}{4}$ in. diameter core, will transmit up to 1650 in-lb of torque at 500 rpm (about 10 hp).

The heart of the shaft is a heavy duty core made up of layers of tightly wound high-grade music wire. The casing is lined with oil tempered spring steel, reinforced with wire braid, and covered with an oil-resistant, neoprene-impregnated fabric and an abrasion-resistant rubber jacket.

The shafts have a square slip coupling at one end with enough play to take care of any slight changes in length due to varying torque loads, the company states. Couplings of various bore are available for connecting up at each end. Steel-backed bronze sleeve bearings support the core at each end of the shaft. **—K-23**

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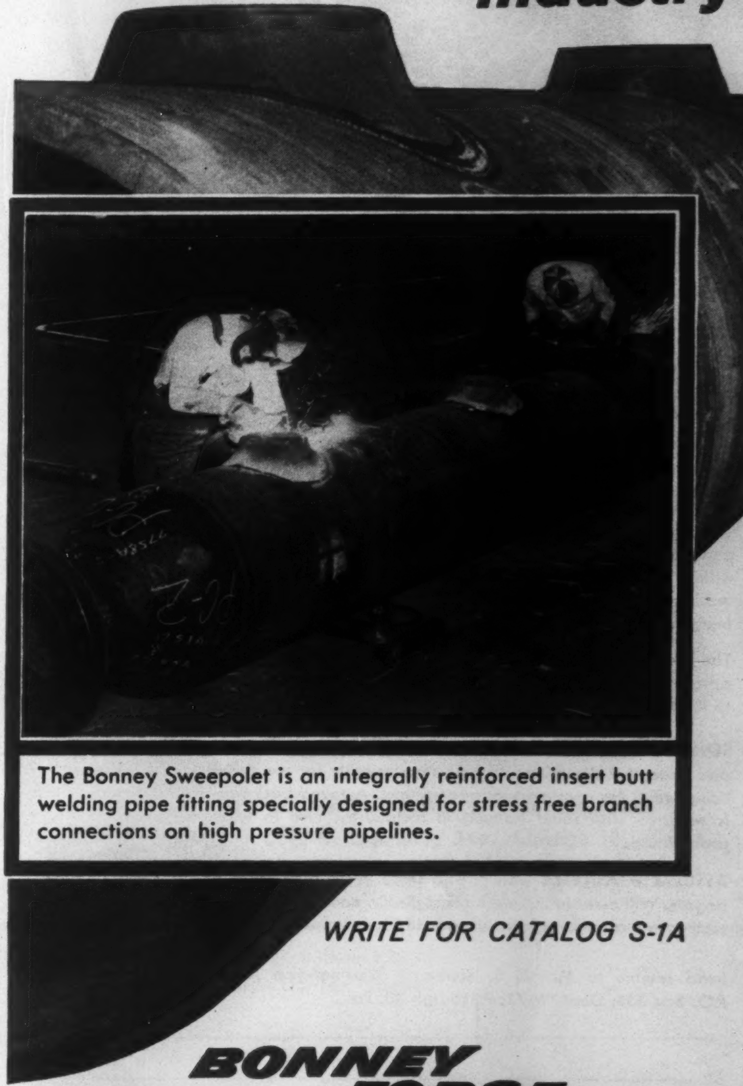

The Bonney Sweepolet is an integrally reinforced insert butt welding pipe fitting specially designed for stress free branch connections on high pressure pipelines.

WRITE FOR CATALOG S-1A

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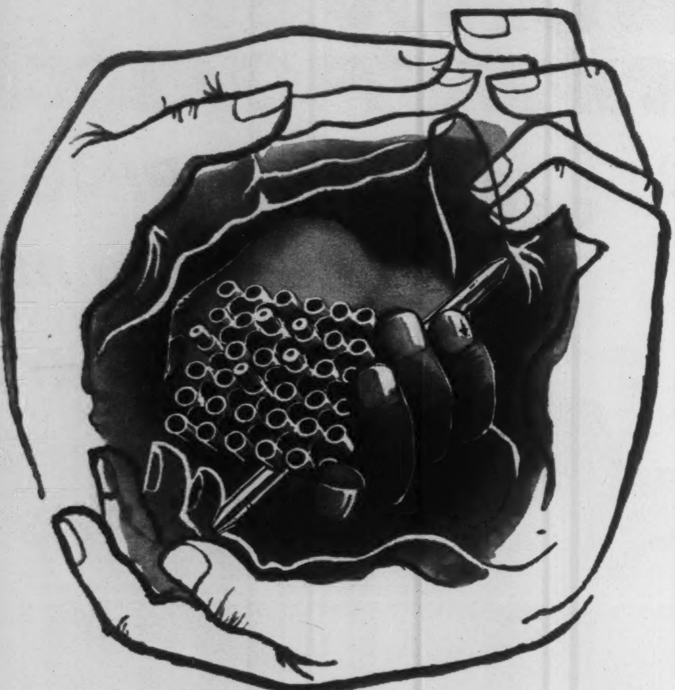

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ASSOCIATE ENGINEER with one to three years experience and a BSME or MSME degree. Will assist in the mechanical design and analysis of reactor core components such as fuel assemblies, control rods and core support structures.

Send resume to Mr. C. S. Southard, Westinghouse Atomic Power Department, P.O. Box 355, Dept. W-71, Pittsburgh 30, Pa.

Westinghouse

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BUSINESS NOTES
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LATEST CATALOGS

Stainless Steel Tubing

Square, rectangular, and special shaped carbon; low alloy high strength; and stainless steel tubing, for pressure, mechanical, heat resisting, ornamental and atomic applications, is now available from Standard Tube Co.

Shaped tubing is formed from round tube stock. Final shapes have approximately the same peripheral dimensions as the original round tubing from which they are formed. Round tube dimensions range from $^{5}/_{8}$ to 6-in. od with wall thickness from .028 to .250 in. for the carbon and low alloy steel, and from $^{5}/_{8}$ to $4^{3}/_{4}$-in. od with wall thickness from .028 to .165-in. for stainless steel. **—K–24**

Battery Charge Chart

A chart which provides a simple method of determining the proper charge rate for any lead-acid motive power battery being charged by motor-generator equipment has been developed by Exide Industrial Div., Electric Storage Battery Co.

For use on electric industrial trucks and mine vehicles, the chart applies to lead-acid batteries of any number or size of cells, in any state of charge, being charged on an 8-hr basis. It can be used to determine the proper rate with either shunt-wound or compound-wound generator charger equipment. **—K–25**

Pneumatic Transmitting Meter

A new pneumatic transmitting meter for air signaling fluid rates of flow to remote-located recorders and controllers has been announced by Schutte and Koerting Co.

The firm states that four calibration adjustments permit accurate field recalibration whenever basic operating conditions change. No cams are used in these adjustments. Another exclusive feature is a magnet design which provides an evenly-distributed magnetic field without drag on the metering float.

The transmitter, designated a Model 58, is a position balance type designed to give a high degree of accuracy. The transmitter is suitable for use on either of the firm's Safeguard glass-tube rotameters or metal-tube rotameters. **—K–26**

Flat Belt Conveyor

Unique flexibility in bagging operations is provided by a new flat belt conveyor which can be adjusted in height as well as length, Richardson Scale Co. has announced.

An adaptation of the Model GA-11 bag conveyor which allows changes in length from 7 to 12 ft, the new unit's standard height of 8 in. can be easily jacked by one operator to any position within a range of 12 in., the company reports.

The new conveyor is designed for all package conveying, and in particular to convey filled bags from weighing and packing equipment through a sewing operation. **—K–27**

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BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

Lightweight Filters

Lightweight filters free of built-in contamination, with media elements locked together mechanically by a specially-developed high pressure process, have been announced by Purolator Products, Inc.

The firm states that a new high pressure process—using special dove-tailed construction—locks together all components of the filter element (including media, end caps, and center tube) so securely that the filter medium is embedded in the parent metal of the end caps to form a leak-proof seal. Since the new process requires no welding, aluminum and dissimilar metals can be used in filter designs, the company says.

The company is producing the filters with stainless steel wire mesh media elements, ranging in size from 1 to $1^3/_4$ in. diam.

—K-28

Deceleration Valve

A new 5-25 gpm deceleration valve for hydraulically actuated machinery, designed to permit external adjustment of back pressure to provide the desired deceleration rate, has been announced by Vickers Inc.

The firm says that to provide proper deceleration characteristics through the complete flow range, the internal port area is altered by the external adjustment. Spool stroke length remains constant regardless of volume setting.

Machine tool set-up time is reduced, the company says, because the new valve eliminates the need for special valves, spool modifications, and deceleration cam alterations. An adjustable needle valve permits metering oil through the valve when complete shut-off is not desired.

Although rated at 5 to 25 gpm nominal flow, the valve can be used for applications up to 60 gpm without malfunction. Maximum recommended operating pressure is 3000 psi. An integral check valve for reverse free flow is an optional feature. The new valve is available in either gasket mounting or threaded port designs.

—K-29

Aluminum Nozzles

A new high pressure nozzle with valve mechanism balanced so it can be opened or shut with one finger—even at pumping pressures up to 150 psi—is announced by Philadelphia Valve Co.

Two models are offered, one for fuel oil trucks on home deliveries, the other for airport trucks fueling aviation gas or jet fuel. Made of aluminum, the nozzles are light in weight. The firm says streamlined internal design maintains full flow area at all points and permits a high rate of flow. Nozzles are surge-proof and nonleaking. New aluminum swivels with nylon bearings are available for fitting nozzles to hoses for easier positioning.

—K-30

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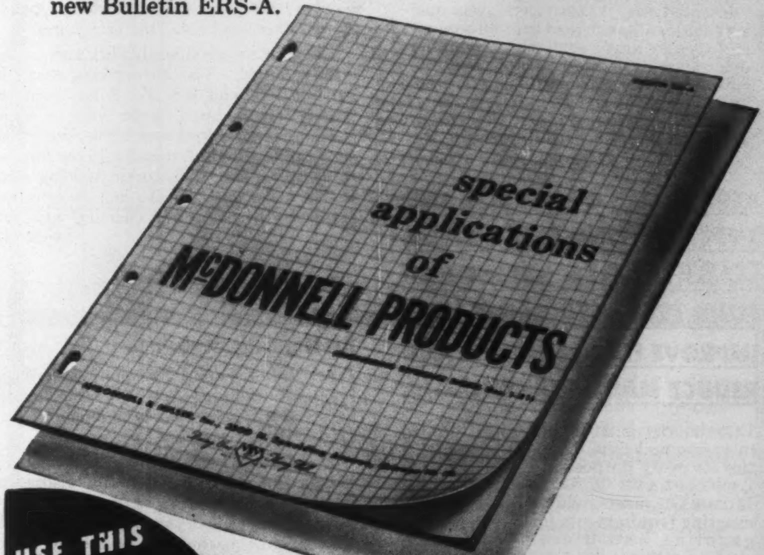

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BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

Nickel-Base Alloy

A new nickel-base alloy, developed as a container material for molten fluoride salts, is now being produced on a developmental basis by Haynes Stellite Co., Div. of Union Carbide Corp.

The new alloy, called Hastelloy alloy N, evolved from work done at Oak Ridge National Laboratories. The firm expects the new alloy to be most useful in normally corrosive environments involving fluorides at high temperatures. One outstanding characteristic is the alloy's resistance to embrittlement upon continuous exposure to service temperatures up to 1600 F, the company reports. Tests have shown sufficient oxidation resistance in air for continuous operation at 1800 F. Intermittent operation at temperatures to 1900 F may also be possible, depending on other conditions, the firm states.

The alloy has good weldability and can be readily forged. The hot-working range is between 1600 and 2150 F. It has been extruded and produced in the form of high-quality seamless and welded tubing. The alloy can be supplied, to order, in the form of sheet, plate, bar, wire, coated welding electrodes; and sand-, shell-, and investment-castings with guaranteed chemical composition. **—K-31**

All-Hermetic Centrifuge

An all-hermetic 5000-gph centrifugal separator, believed to have the highest capacity of its type, has been announced by De Laval Separator Co.

Designated the SRG-214, the machine is designed to separate or clarify viscous or inflammable materials, or materials which must be kept from contact with air. The firm says the machine can be used for water washing some of the newly developed long-chain plastic materials under conditions of high temperature and pressures.

The SRG-214 is a disk-type constant efficiency centrifuge, with specially designed long-life seals at the inlet and outlets. The company says the seals assure air-free operation at pressures up to 125 psig, so that the feed material enters and is maintained under positive pressure. As a result, the machine is well-suited for high-capacity vegetable oil refining and degumming and for clarifying of materials such as synthetic latex and viscous plastics dissolved in solvent.

Except for the frame, which is heavy duty cast iron, all parts, including the bowl, bowl disks, bowl cover, and outlets are of solid stainless steel construction. The machine, which requires 20 hp, can be used with either direct motor drive or supplied with V-belt pulley for separate motor drive. Bowl diameter is 24 in. and bowl speed is 4400 rpm. The machine weighs approximately 2600 lb less motor. **—K-32**

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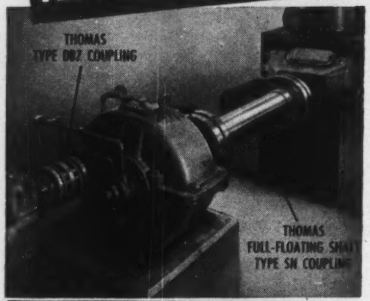

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Geared Motor

Electro Products Div., Western Gear Corp. announces the design and manufacture of an azimuth drive geared motor.

The motor is three phase, 400 cycle, 200 volt a-c-operated and is $^{1}/_{10}$ hp. The motor speed of 11,000 rpm is geared down to 290 rpm continuous duty operation in accordance with the requirements of MIL-M-7969A. The motor is identified as Model 31R48R73 and is 2 in. in diameter by 4 in. in length.
—K-33

Electrohydraulic Valve

Kearfott Co., a subsidiary of General Precision Equipment Corp., has introduced a unity-coupled shear orifice electrohydraulic servo valve, Model 6103, designed as a component for high performance missile and aircraft hydraulic systems.

The valve, said to be capable of optimum performance in severe environments, consists of two moving parts: a spool and a sliding fork integral with a torque motor's armature. Of titanium construction, this valve has large, full-opening shear seal orifices designed to virtually eliminate silting problems, while high shear forces clear the valve of contaminants.

Essentially a two-stage four-way control valve, the units first stage consists of an electrical torque motor and a shear-seal orifice hydraulic amplifier; its second, or control stage consists of a precisely matched spool and sleeve arrangement.
—K-34

Expansion Joints

A line of pressure-balanced expansion joints for absorbing pipeline movement without imposing pressure thrust is announced by Zallea Brothers.

Installed at elbows or points where piping changes direction, the pressure-balanced expansion joints use a counterbalancing outer bellows to absorb line pressure where anchoring is not practical.

The firm says the joints have application in missile and jet engine propulsion test facilities, chemical plants, paper mills, steel mills, refineries, oil and gas lines, power plants, steam lines, water works, gas works, and wind tunnels. They are also frequently used to protect turbine housings and exhaust connections, stage bleeders, condensers, pumps, and rotating equipment such as turbines and blowers.
—K-35

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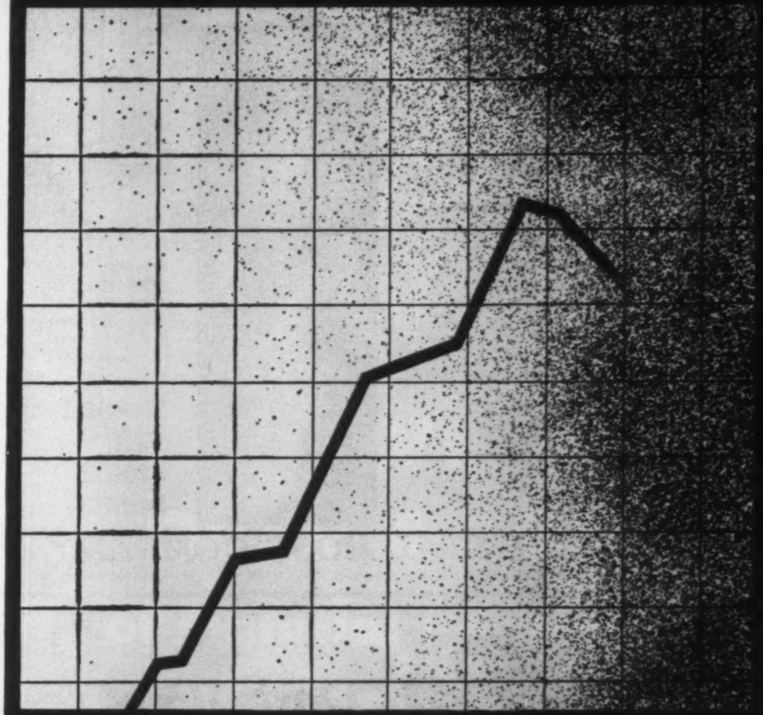

Let Pangborn Dust Control chart new profits for you!

If you have uncontrolled dust in *your* plant, you automatically have reduced profits! It's a matter of simple arithmetic—just add up the cost of lost salvageable material, housekeeping expenses, excess machine wear, intangibles such as community and employee goodwill. Whether the total is moderate or high, you'll find that efficient Pangborn Dust Control will cost you considerably *less!*

For details on Pangborn's experience and engineering knowledge, talk to the Pangborn man in your area or write PANGBORN CORPORATION, 2200 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control and Blast Cleaning Equipment—Rotoblast® Steel Shot and Grit.* ™

Pangborn CONTROLS DUST

NEW Allflex VIBRATION TAMERS

FOR EFFECTIVE PIPELINE VIBRATION CONTROL

- Remove "shakes" • Dampen noise
- End stressed fitting failures
- Prevent cracked walls • Compensate for expansion • Stop costly repair "downtime"
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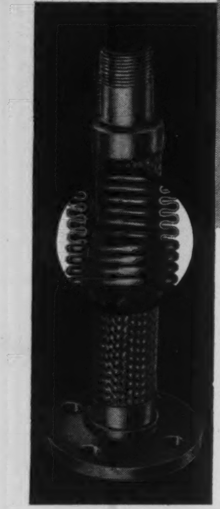
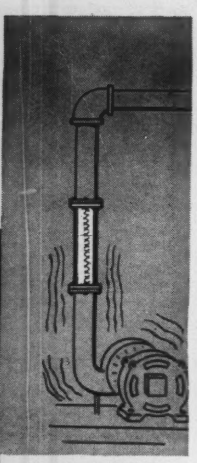
ALLFLEX "VIBRATION TAMERS" are sold through leading Industrial Distributors. If not available locally, IMMEDIATE FACTORY SHIPMENT . . . IS ASSURED!

Write, wire, or phone TODAY for helpful, fact-filled ALLFLEX ENGINEERING DATA SHEET.





Standard ALLFLEX "VIBRATION TAMERS" have Flanged or Threaded End Connections (either or both available) in

STAINLESS STEEL
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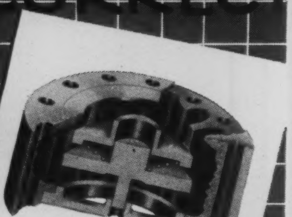

Figure 329
Center-guided type
for 1" to 10" lines

Figure 636
Globe type for 3" to 24" lines

FOR SURE SURGE-PRESSURE PROTECTION

By closing instantly whenever flow reversal starts, or when flow is zero — these valves assure protection for piping, pumps and other components. Silent in operation, built of material to meet any service, usable in any position. *Write for Bulletins:* No. 654 on Valves; No. 851 on Cause, Effect and Control of Water Hammer.

Williams-Hager
Silent
CHECK VALVES

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149 Stanwix Street
2 Gateway Center • Pittsburgh 22, Pa.
Our 74th Year • 1886-1960

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BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

Submaster Regulator

A new submaster regulator has been developed by Powers Regulator Co. for accurate control of remotely readjusted temperatures in heating, air conditioning and industrial processes.

The device, Series 200, is a pneumatically operated temperature controller, whose control point is reset by a master controller or positioning switch. The master may be a thermostat, hygrostat, pressure regulator, or a manual positioning switch, the company states.

The submaster has a throttling range adjustment of 0 to 35 per cent. The gas-filled thermal system is unaffected by cross ambient bulb and capillary temperatures. The firm says it also eliminates the need for bulb elevation correction.

It is provided with direct action and reverse adjustment. Action and adjustment can be converted. **—K-36**

Proportioning Pump

A new, low cost, electrically-driven Chem-O-Feeder for the accurate proportioning of concentrated corrosive chemicals has been announced by B-I-F Industries, Inc.

The diaphragm-type pump, Model 1331, is made of corrosion-resistant materials and will effectively meter such chemicals as 66 deg Baumé sulfuric acid, sodium hydroxide, phosphoric acid, photographic solutions, hydrofluosilicic acid. It has adjustable stroke length while in motion.

The positive displacement pump is installed either floor, shelf or wall-mounted, and takes suction directly from the shipping container. Range is over 4 to 1 with capacity up to .7 gph into discharge pressures up to 100 psig. Package ready for installation consists of the pump, foot valve, injection nozzle, connecting hoses and instructions. **—K-37**

Automatic Door Operator

A heavy-duty automatic overhead door operator designed for oversize garage doors has been announced by Alliance Mfg. Co., Div. of Consolidated Electronics Industries Corp.

Called the Genie Model 410, the unit is designed to provide a reliable lifting force of 250 lb, sufficient to operate oversize garage doors up to 10 ft high and 20 ft wide. It automatically unlocks and opens or closes and locks the door at the push of a button, while at the same time turning garage lights on or off.

The unit employs a single button control. Successive operations of the button cause the door to open, stop, reverse direction and close, the firm reports. **—K-38**

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BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

Sampling Switch

Roto-Jet, a noiseless sequential sampling switch capable of making more than 3600 closures per second, is announced by Electric Regulator Corp.

Actuated by a rotating jet of air, its only moving part, the new wiperless switch is said to represent an important innovation in the field of high-speed switching where a large number of voltage-generating elements must be connected successively to a single load.

Signals of one, two, and three mv can be transmitted completely free from noise without amplification or filtering of any kind, the firm reports. Applications include use with thermocouples, strain gages, light-sensitive devices, and similar low-level, high-impedance elements employed in computers, telemetering, and complex process control systems. Sampling speeds are available up to 40 revolutions per second. **—K-39**

Displacement Meter

What is claimed to be the world's largest positive displacement meter has been announced by Ralph N. Brodie Co.

The new BiRotor meter, designated the B-142, stands 9 ft high and has a working capacity of 20,000 barrels per hr at 150 psi.

The meter's alloy-iron measuring elements are so balanced that pressure from a single finger will move them easily, the firm reports.

The unit is designed to measure crude and refined products with high precision and at full rated capacity. **—K-40**

Boiler Water Gage

Jerguson Gage & Valve Co., announces the Refraport Gage, a new high-pressure boiler water gage for up to 3000 psi.

The new gage is said to be a new concept in high pressure boiler water gages, designed to meet the needs of the many new plants being built for WSP in the vicinity of 2400 psi. The water level shows black, similar to reflex gages; the steam space above shows as a line of brilliantly lighted bulls eyes with a clean line of demarcation designed to make it easy to read the level directly or in TV or mirror transmission.

The firm says the gage is designed to use the principles of light refraction. It has a single chamber machined from a solid piece of steel, with front and back ports. Each port is covered with a circular borosilicate glass, protected by a thin mica shield, and each glass has an individual cover.

A specially designed illuminator at the back of the gage throws a brilliant beam through the ports. The light passing through the water is refracted so it does not come through the front ports, thus leaving them unlighted. The light passing through the steam above the water level, however, streams through the front ports in a series of brightly lighted spots. **—K-41**

SLY DYNACLONES®
at American Potash

SAVE
OVER A TON
of Material Per Hour

At its Trona, Cal., plant, American Potash & Chemical Corporation uses 4 Sly Dynaclone Dust Filters at the Borax Refinery, Borax Shipping Station, Coarse Granular Potash Plant, and Potash Shipping Area (pictured above). During every hour of operation, the Dynaclones recover an estimated 1260 pounds of borax and 1140 pounds of potash.

In addition to these substantial material savings, the Dynaclones are the key to improved health and safety, better housekeeping, more efficient plant operation. Good performance, long bag life and nominal maintenance requirements are noteworthy Dynaclone features.

Put the "Roll-Clean" Dynaclone to work on your continuous processes. Benefit from these advantages: Constant, uniform suction at dust sources, 24 hours a day if required. Automatic bag cleaning. More cloth per cubic foot of filter. New "Resist-O-Wear" filter bags (patent pending) — as much as 3 times longer life.

Get complete Dynaclone details . . .
Send for Catalog 104

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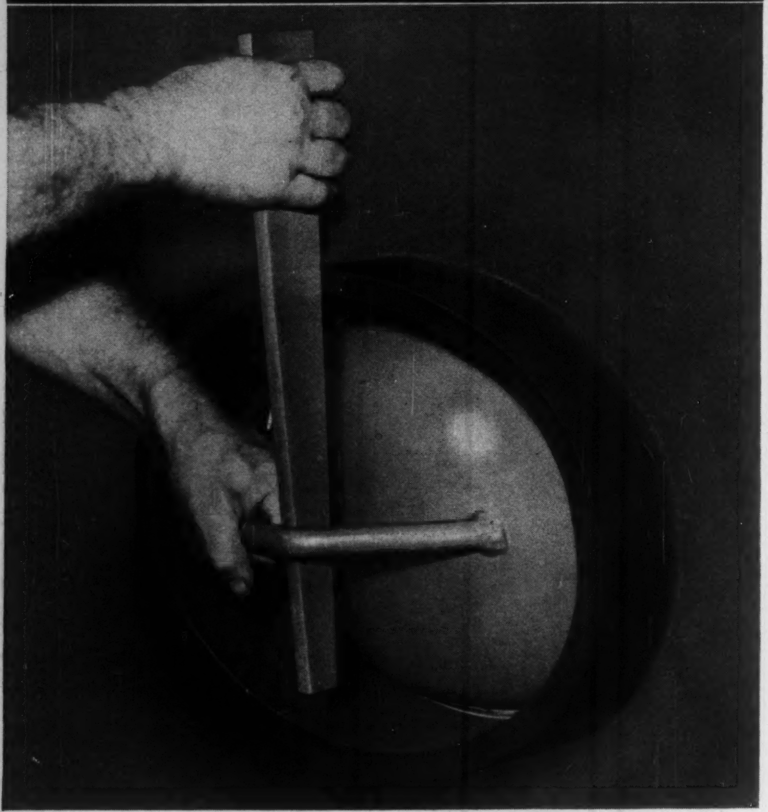
THE W. W. SLY MANUFACTURING CO.
4768 TRAIN AVENUE • CLEVELAND 1, OHIO
OFFICES IN PRINCIPAL CITIES
OVERSEAS LICENSEE: ANDREW AIR CONDITIONING LTD., LONDON S.W. 1, ENGLAND

NEW LENAPE WEDGE MANWAY*
Eliminates Bolts and Yokes



This revolutionary, new manway is not only easier to open and close, but is actually more economical than conventional bolted covers. Noted for its simplicity, the Lenape Wedge Manway assembly is a unique combination of only three metal parts—ring, cover and key wedge, plus a standard gasket, and is supplied as a "package" assembly.

FAST, SIMPLE OPERATION—As illustrated, to close the manway you insert the key wedge under the cover handle and over the opposite ring wall. Then, merely tap the wedge gently with a hammer until a tight seal is secured. That's all there is to it. Troublesome bolts and yokes are completely eliminated. Uniform gasket loading is assured.

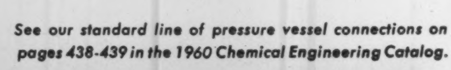
To open, you just tap out the wedge and remove the cover—all in a matter of seconds.

Write today for full details and prices on the amazing new Wedge Manway Assembly—another Lenape exclusive.

**Patent pending*

See our standard line of pressure vessel connections on pages 438-439 in the 1960 Chemical Engineering Catalog.

LENAPE
PRESSURE
VESSEL
CONNECTIONS



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Vertical Turbine Pumps

Expansion of its centrifugal pump line with the addition of 40 sizes of vertical short-coupled turbine units has been announced by Allis-Chalmers, Milwaukee 1.

These are available in ratings of 20 to 8000 gpm at heads to 400 ft and over depending upon the number of stages.

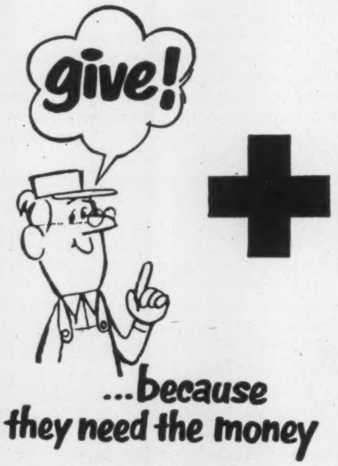
Designed for cooling towers, circulating or process pumping, lake and river intakes, boosters, fire pumps, drainage, pipe line boosters, filter washing and dewatering, the pump is said to afford space saving through integral construction of motor support and discharge head which reduces the base requirements.

Because its pumping element is usually submerged, the pump seldom needs priming. Its discharge column can be varied for changing requirements and its head and motor can be located above highwater to avoid flooding and motor damage. **—K-42**

Aluminum Chain Hoist

The Hadef line of lightweight aluminum alloy hand chain hoists, in capacities from $^1/_2$ to 10 tons, manufactured in West Germany and in use in 25 countries throughout the world, is being introduced in the U. S. for national distribution by the importer, Consolidated Equipment Sales.

The hoist features complete casing of hand and load chain wheel. The unit has a $^1/_2$ ton size weighing 26$^1/_2$ lb, including chains, and new patented clickless load brake. **—K-43**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BLOOD BANK • TRAINING PROGRAMS

Continued on Page 157

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1
4
6
7
8, 9
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11
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14, 15
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K-1
K-2
K-3
K-4
K-5
K-6
K-7
K-8
K-9
K-10
K-11
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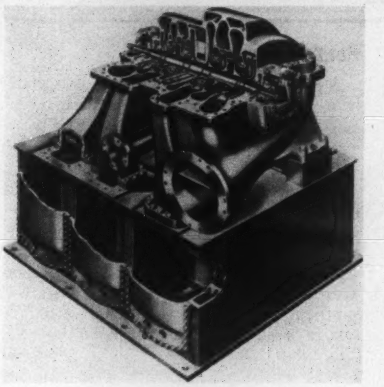

Centrifugal Compressor

A new, high efficiency, multi-stage centrifugal air compressor, designed to furnish 100 lb air for oxygen plants, centralized air systems and other industrial air applications has been introduced by Clark Bros. Co., one of the Dresser Industries.

Designated the H Line, the new series features integral intercoolers between each stage of compression. Six case sizes are available with horsepowers ranging from 1000 to 8000 bhp and capacities from 5000 to 38,000 cfm.

Each unit is supplied as a complete package including matching driver, intercoolers, and lubricating system. —K–44

Latitude Counter

A miniature latitude counter which reads directly in degrees and minutes of north or south latitude has been developed by Veeder-Root Inc.

The firm says the new counter, developed for a computer-controlled airborne navigation system, is non-repetitive, and therefore can be operated to a "maximum" reading of 99 deg before coming up against a mechanical stop. This, the company states, provides a margin of safety against accidental breakage in case of computer malfunctioning which might result in unidirectional operation beyond the navigational maximum of 90 deg.

At the zero end of the scale (Equator), a north-south shutter is actuated. Should the aircraft cross the Equator on a southbound course, for example, the shutter would read "North" and display a reading in north latitude down to and including the zero mark. As the plane continued south and the counter moved off the zero mark, the shutter would be actuated and would obscure the first set of figures, revealing a new set preceded by the legend "South." Thus, the instrument always reads directly in degrees and minutes of north or south latitude. —K–45

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solves many DESIGN problems

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SYNTRON designs, engineers and manufactures a complete line of equipment that can be used as components of other devices — producing a practical, proven answer to many design problems involving controlled vibratory motion (conveying, settling, elevating and agitating bulk materials), rotary shaft sealing (gas or liquid), automatic parts orientation and feeding, hopper level and flow control.

SYNTRON Equipment offers you more than 35 years of engineering experience in all types of industry.

If your current plans entail problems that can utilize such equipment it will pay you to call your nearest SYNTRON representative. — or write for a free SYNTRON Catalog

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NEW EQUIPMENT
BUSINESS NOTES
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Back Pressure Regulators

Back pressure regulators are available from OPW-Jordan in ductile iron No. 1165 or bronze No. 1265 in $^1/_2 - 2$ in sizes.

The firm says the units are suitable for pressures to 250 psi wsp and temperature to 500 F. They are designed to control 50–6600 lb of steam per hour or 7–190 gallons of water per minute.

Sliding Gate seats are designed to slice across flow to give balanced action. The seats are also self-cleaning and self-lapping to insure tight shut-off during the life of the regulator. **—K-46**

Pendent Switch

A pendent "safe" switch is now available in a 6-station as well as a 4-station model, according to new illustrated literature released by Electrical Products Div., Joy Mfg. Co.

By means of an overlay design in the literature the reader is given an "x-ray" view of the switch both inside and out. Shown are switch wells, water seals, and micro-type positive switches in position. The entire unit is enclosed in an improved synthetic rubber compound. The unit is said to be watertight and corrosion-proof. **—K-47**

BUSINESS NOTES

Development Unit Formed

Research Div., United Shoe Machinery Corp., announces the formation of its Advanced Development & Systems Dept. The firm says the purpose of this department is to expand United's participation in government and industrial contract activity. It will function as an integrated facility performing research and development, engineering and custom manufacturing.

Denver Subsidiary

Keuffel & Esser Co. has announced establishment of Keuffel & Esser of Colorado, Inc., a new subsidiary branch in Denver.

Products formerly were distributed exclusively by the Kendrick Bellamy Co. in Denver. Keuffel & Esser Co. in America's oldest and largest manufacturer of quality engineering and drafting equipment and materials.

Ceramic Department

A new manufacturing department has been established by Corning Glass Wks. for production of ceramic parts primarily for the electronics industry.

The new department will produce ceramic and sintered glass parts for products such as power, microwave and transmitting tubes and other electronic devices, as well as for industrial applications. Sintered glass products are sold under the name, Multiform.

WATER PRESSURE CONTROLLED

G-A *Cushioned* Water Pressure Reducing Valve

Like the elephant, water pressure can be big trouble if not controlled. That's what the Golden-Anderson Pressure Reducing Valve does. This sensitive valve always delivers water at the same predetermined pressure . . . regardless of upstream variance. No need to fear water line damage from high initial pressures with this Golden-Anderson Valve on the job.

Write for Bulletin W-3A

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Designers and Manufacturers of VALVES FOR AUTOMATION

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NEW EQUIPMENT BUSINESS NOTES LATEST CATALOGS

Atomic Fuel Production

Westinghouse Electric Corp. has announced expansion of its nuclear core manufacturing laboratories at Cheswick, Pa., to provide additional development and production facilities for nuclear fuel elements and core components.

The company reports that a new facility is nearing completion which will house a newly formed group—the Nuclear Components Development Laboratory. Heretofore, cores built in the present building have been under government contracts for use in the U.S. Navy's nuclear propulsion program.

LATEST CATALOGS

Stainless Electrodes

Harnischfeger Corp. offers Bulletin R-49 giving specifications on its extended line of stainless steel electrodes covering all AWS-ASTM types. —K–48

Multipress Line

A four-page bulletin, 195-B on its multipresses has been published by Denison Engineering Div., American Brake Shoe Co.

The brochure gives general data on its entire line, including the new R, S, and T series available in a variety of models with capacities of from 1 to 12 tons. These new design bench-type presses design conform to JIC specifications. Standard accessories are also described in this bulletin. —K–49

Program Control System

A four-page data sheet describes operation of Leeds & Northrup Co. new master-slave program control system which is designed for applications where temperature uniformity is of prime importance.

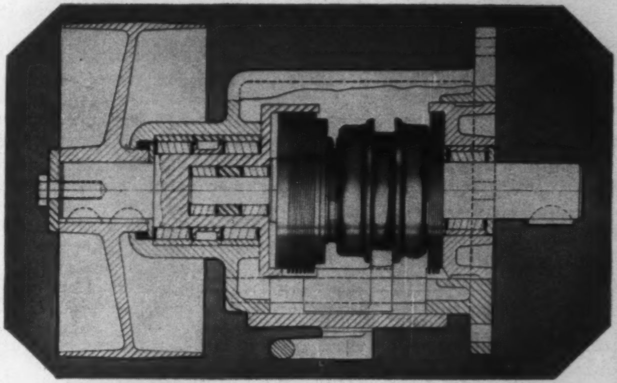
The system already is being used in the brazing of stainless steel honeycomb panels for supersonic aircraft and missiles. The data sheet includes a schematic to illustrate flexibility of the system, a table describing each component, and a graph which shows how the system can take the product through a typical program—from pre-heat through aging—without transferring the product to separate process equipment for sub-zero temperatures. —K–50

Heat Exchangers

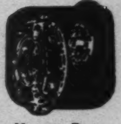
A 12-page illustrated bulletin, Catalog Section S-6620, on Karbate impervious graphite immersion heat exchangers and circulating steam jets for heating or cooling corrosive solutions in all types of tanks is available from National Carbon Co., Div. of Union Carbide Corp.

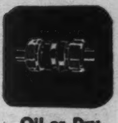
Separate sections on plate, bayonet, and coil type immersion heat exchangers include general descriptive, installation, and operation information. Dimensioned sketches of each type give construction details, and tables present information on weights and effective surface areas. Specifications on circulating steam jets include dimensions and installation instructions. —K–51

ROCKFORD



Small Spring Loaded


Heavy Duty Spring Loaded


Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

Precision Positive Neutral With Pullmore Clutches

When the powerful engagement of PULLMORE Multiple-Disc CLUTCHES is released, declutching is instant, positive and precise. The perfectly flat, floating discs separate and ride free—without drag, heat or abrasion. This positive neutral is especially valuable in rapid-operating, multiple-cycle machines. Let our engineers acquaint you with this special control of live power.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER-TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

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1307 Eighteenth Ave., Rockford, Ill., U.S.A.
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CLUTCHES

Yoder Rotary Slitters reduce inventory... speed production

To help meet the demands of tight production schedules, YODER Slitters reduce mill-width stock quickly and economically to desired widths. If your needs are as low as 100 tons per month, time and man-power savings alone will offset the cost of your YODER Slitter in a matter of months, while reducing basic inventories. Compactly designed, standard YODER Slitters are built to handle standard coil widths... completely engineered lines for special requirements.

YODER accessories, such as coil cars, swivel unloaders, scrap choppers, scrap disposers, plate levelers and coil boxes, make stock handling fast and easy.

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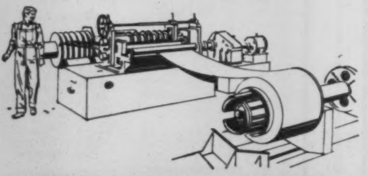

ENGINEERING YODER MANUFACTURING

ROTARY
SLITTING
LINES

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LATEST CATALOGS

Counting Devices

A folder describing advantages to be gained by including counting devices in the design of machinery has been published by Veeder-Root Inc.

The eight-page flyer includes illustrations of various counters, and mentions some of the benefits obtained through incorporation of mechanical, electro-magnetic and photoelectric counters in modern machinery. Included in the descriptions are revolution counters, geared counters, ratchet counters, and types featuring high speed, reset, lineal measuring, remote data readout, predetermining of quantities or other quantitative data, and computation of varied coordinates.

—K-52

Packaged Compressors

An eight-page bulletin describing the construction and operating features of AM/2 and AM/4 packaged compressors for gas gathering is available from Cooper-Bessemer Corp.

Bulletin 91 discusses the incorporation of large compressor concepts in these compact, heavy-duty units. Construction details are given on both the two-throw type and the four-throw type, covering the complete range from 100 hp up. A number of types and sizes of compressor cylinders can be supplied for either model, at discharge pressures up to 6000 psi.

—K-53

Motion-Control Sheaves

T. B. Wood's Sons Co. has issued Bulletin 8102 describing MCS variable-speed sheaves with resilient cam-follower design to eliminate freezing and sticking and hold a constant driven speed under varying torque loads.

Patented construction is shown by cutaway photo and diagram. Tables facilitate the selection of companion sheaves and belts to meet specified drive requirements. Companion sheaves, variable-speed belts and motion-control motor bases are also covered in the eight-page bulletin.

—K-54

Inclinable Presses

A new line of Series AF inclinable presses, featuring an instant engaging, low inertia friction clutch and brake, is covered in 24-page Bulletin 55, issued by Niagara Machine & Tool Wks.

A description of standard and optional features, specifications, die space dimensions, strokes and shut heights are included.

—K-55

Curve Crown Pulley

Stephens-Adamson Mfg. Co., has announced the availability of Bulletin 558 on its new curve crown welded, all steel pulley.

The new literature features technical and engineering data, specifications, diagrams and illustrations.

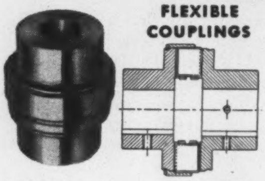
—K-56

Continued on Page 162

LOVEJOY
POWER
TRANSMISSION
EQUIPMENT

EASILY INSTALLED, MAINTENANCE-FREE

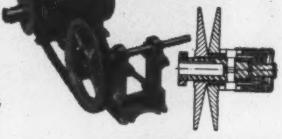
FLEXIBLE COUPLINGS



REQUEST
CATALOG
C-58

Bores (max.)..........5/16" to 9½"
O.D. ....5/8" to 21½"
Wt. ....½ oz. to 1500 lb.
H.P. ....1/20 to 4250
Torque (static). 1½ to 5100 ft.-lbs.

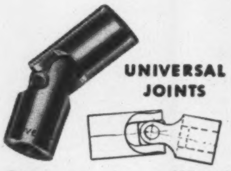
VARIABLE SPEED PULLEYS



REQUEST
CATALOG
P-58

Bores (max.) ...... ½" to 1⅞"
O.D. ....3" to 13⅝"
Belt Sizes...........A to 2¾ TW
Speed Ratios,..........1-1 to 8-1
H.P. (1750 rpm.).........¼ to 15

UNIVERSAL JOINTS



REQUEST
BULLETIN
820

Bores...................¼" to 2"
Hub Dia. ....½" to 4"
Static Torque
340 to 130700 in.-lbs.
H.P. (100 rpm.).........½ to 207

VERSA-MOUNT TAKE UP FRAME

REQUEST
BULLETIN
V-647

For All Pillow Blocks—Ball, Roller or Babbitted
Mount Top, Side, Inverted or Reverse-foot
Sizes ....½" to 2-7/16" Blocks
Travel lengths ...... 2" to 36"

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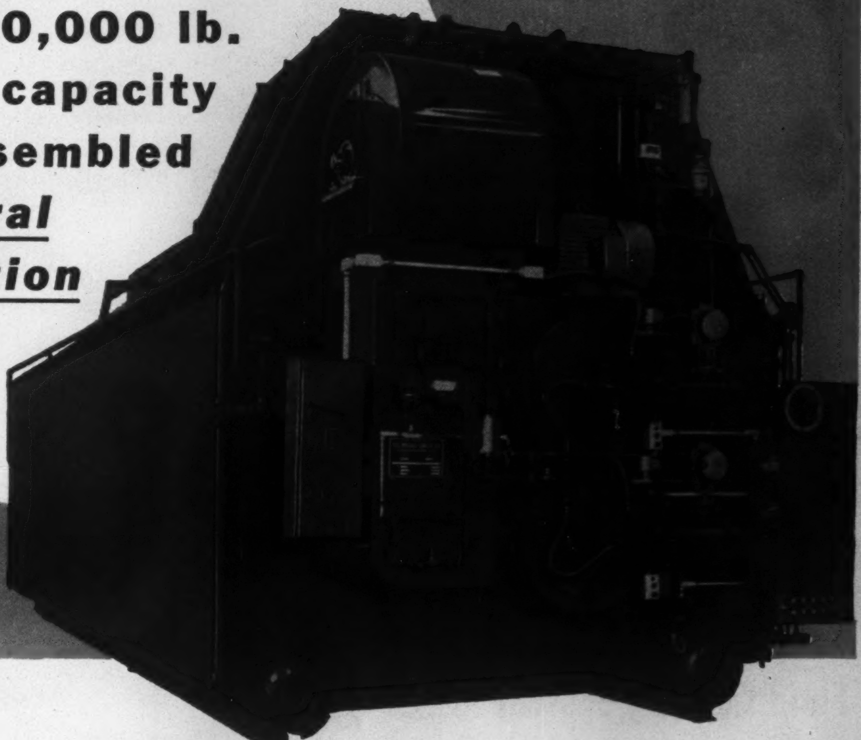
LOVEJOY FLEXIBLE COUPLING CO.
4832 WEST LAKE STREET • CHICAGO 44, ILLINOIS

...now from WICKES

a new 100,000 lb. per hour capacity shop-assembled *natural circulation* boiler



Wickes Type A units are of simple design, ruggedly constructed and adaptable to a variety of operating conditions and may be fired with oil, gas or combination of both.

All units are shipped completely shop-assembled including superheater, fuel burning equipment, safety and combustion controls, forced draft fan and drive, soot blowers and feedwater regulator.

Save on

- **First Cost**
- **Operating Expense**
- **Space**
- **Delivery Time**
- **Installation Time**

For more detailed information on Wickes Type-A steam boilers, write for our catalog 56-1. Bulletin 55-1 covers the complete line of Wickes Products and Facilities.

WICKES typeA

WICKES

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DIVISION OF THE WICKES CORPORATION

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POSEY-Fabricated Vulcanizer

87" Diameter
80" Height

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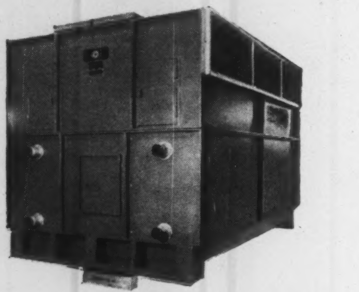
Steel Plate Fabrication • Lancaster Mixer and AutoBrik Machines • Tunnel and Mine Equipment • Iroquois Asphalt Plants • Iron and Steel Foundry • Industrial Heating Equipment

This Self-Contained Fluid Cooling System ... gives most accurate temperature control



Applied in cooling industrial machines or processes to temperatures approaching the ambient wet-bulb, the NIAGARA *Aero* HEAT EXCHANGER is independent of any more than a nominal water supply or disposal. The coolant system is a closed one, free from dirt and maintenance troubles.

Heat is removed from your process *at the rate of input,* giving you precisely the temperature you require and assuring the quality of your product. Heat may be added to prevent freezing in winter or for better control in a warm-up period. Liquids or gases are cooled with equal effectiveness.

Heat is rejected outdoors. Only the little water evaporated on the cooling coils in the air stream, or discharged to prevent hardness build-up, is consumed.

Niagara sectional construction saves you much installation and upkeep expense, gives full access to all interior parts and piping. Your equipment always gives you full capacity and "new plant" efficiency.

Write for Niagara Bulletin No. 132 for complete information

NIAGARA BLOWER COMPANY
Dept. ME-1, 405 Lexington Ave., New York 17, N.Y.
District Engineers in Principal Cities of U. S. and Canada

KEEP INFORMED

BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

Shaft Seal

Information and engineering data on a new corrosive service shaft seal made from Teflon are contained in a bulletin published by Crane Packing Co.

The seal described is designed to handle all concentrations of acids and salts, strong oxidizing or reducing agents and all organic compounds. A bellows type construction makes it suited for many slurry applications because it eliminates improper seal operation due to slurry build-up along the pump shaft. **—K-57**

High Alloy Castings

A comprehensive analysis of the factors involved in selecting high alloy heat resistant castings for applications where temperatures exceed 1200 F is presented in a reprint released by the Alloy Casting Institute.

The data separates the 14 ACI cast grades available for high temperature service into three distinct groups, according to their chromium and nickel content. This division of grades makes it convenient to indicate which group of alloys is most applicable for any specific high temperature environment, and also the degree of preference within each group. **—K-58**

Laminated Plastics

Application information and engineering data on laminated plastics and vulcanized fibre is given in a condensed catalog published by Taylor Fibre Co.

Text describes the materials in general terms, telling how they are made and where they can be used. It points out that more than 50 grades are available to meet any requirement. General data and engineering data for 21 of the most common grades of laminated plastics are listed along with suggested applications, corresponding NEMA grades, military specification, color and forms and sizes, physical, mechanical, and electrical properties. **—K-59**

Oxygen Steel

Kaiser Steel Corp. has published a 16-page illustrated booklet describing a technological advance in steelmaking—the production of basic oxygen steel, at its Fontana, Calif., mill.

The firm says oxygen steelmaking is a revolutionary new method of producing steel in minutes instead of hours. The booklet describes how the mill's oxygen steelmaking furnaces are constructed and how they are operated. It also gives a brief history of the development of the new steelmaking process and its adoption by the steel industry throughout the world. **—K-60**

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Blast Cleaning Barrels

A 16-page bulletin, No. 706, by Pangborn Corp. covers equipment for cleaning small-to-medium size castings, forgings or heat treated parts, molders of plastic forms, and reconditioners of brake shoes and other auto parts.

Bulletin No. 706 describes features found in the firms standard duty line of Rotoblast cleaning barrels from $1^1/_2$ to 18 cu ft capacity. In addition to photographs and cut-away diagrams, the bulletin gives dimensions and specifications of the barrels described. **—K–61**

Valve Specifications

A revised version of its comprehensive 500-page valve catalog, No. 60, is announced by the Lunkenheimer Co.

The new publication features a 24-page valve selector and more than 100 pages of engineering data. The complete line of steel, iron, bronze, and PVC valves is presented, along with specifications and illustrations on lubricating devices, boiler mountings, cocks and other products. **—K–62**

Tube Fittings

Parker Fittings & Hose Div., Parker-Hannifin Corp. has issued a four-page folder offering condensed information to help select proper fittings for various service and installation requirements.

Included are shape charts for six types of industrial tube fittings and illustrations of tube-working tools. **—K–63**

Vibrating Conveyors

Syntron Co. announces the availability of a four-page catalog section on mechanical vibrating conveyors, designed for the high-speed conveying of most bulk materials.

The catalog presents descriptions, data and specifications for seven standard mechanical vibrating conveyors—four light tonnage models and three heavy tonnage models. In addition to conveying, the firm reports, they can be used for preheating, drying, or cooling bulk materials with heated, stepped or water cooled troughs, simultaneous scalping or sizing and conveying when fitted with screen decks, and picking tables for the manual removal of foreign objects. **—K–64**

Thermal Elements

A 29-page booklet describing the origin and operation of the snap-acting disk type thermal element, called the Spencer Disk, is available from Texas Instruments, Inc., Metals and Controls Div.

The publication details how the disk actuates Klixon thermostats, circuit breakers, and inherent overheat motor protectors, including the recently developed line of inherent overheat protectors for high performance motors. It also outlines other controls, not disk-actuated, such as motor starting relays, precision switches, and thermal valves. **—K–65**

Leaded Steel Bars

Joseph T. Ryerson & Son, Inc. has issued a revised bulletin on additional types of leaded steel bars including Ledloy 375, said to be the fastest machining steel available.

Stock sizes and shapes of more than 20 different kinds of cold finished carbon steel bars are shown, along with comparative data on strength, workability, machinability, heat treatment response and cost. **—K–66**

YOUR FIRST CHOICE –
PULSCO*
NOISE and PULSATION
CONTROL
DEVICES

Quiet that noisy blower with a . . .
PULSCO SUCTION MUTE®
FOR ALL TYPES OF CENTRIFUGAL BLOWERS, RECIPROCATING COMPRESSORS, ROTARY AND AXIAL FLOW COMPRESSORS.

A. MUTES SUCTION NOISES
B. IMPROVES BLOWER PERFORMANCE WITH LOW PRESSURE LOSS
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SUBDUES PIPELINE VIBRATION
FOR ALL TYPES OF ROTARY, RECIPROCATING COMPRESSORS, VACUUM PUMPS AND PNEUMATIC VAPOR AND STEAM SYSTEMS.

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LIQUID
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PULSE TRAPS*
1. ELIMINATES METER ERROR.
2. REDUCES MAINTENANCE COSTS.
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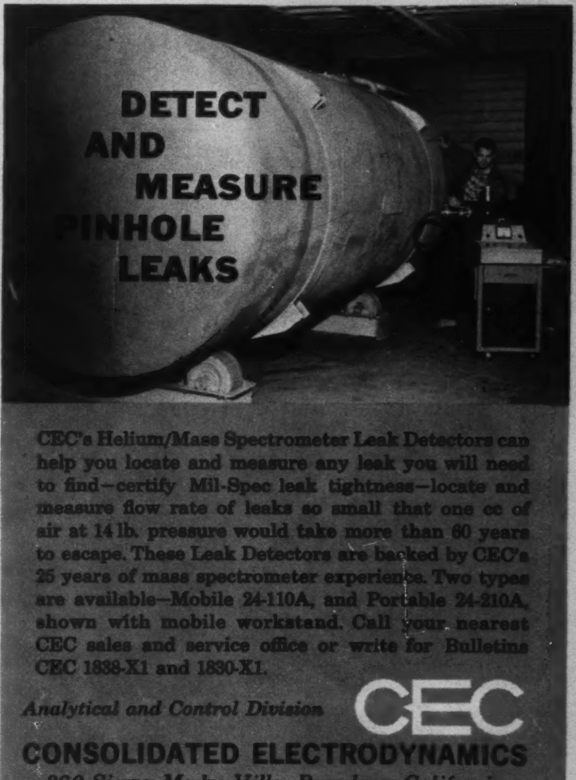
DETECT
AND
MEASURE
PINHOLE
LEAKS

CEC's Helium/Mass Spectrometer Leak Detectors can help you locate and measure any leak you will need to find—certify Mil-Spec leak tightness—locate and measure flow rate of leaks so small that one cc of air at 14 lb. pressure would take more than 60 years to escape. These Leak Detectors are backed by CEC's 25 years of mass spectrometer experience. Two types are available—Mobile 24-110A, and Portable 24-210A, shown with mobile workstand. Call your nearest CEC sales and service office or write for Bulletins CEC 1838-X1 and 1830-X1.

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New Publications

STRUCTURAL DAMPING

In this book engineers and scientists will find a wealth of information useful in engineering design, such as:

the discussion concerning the principal mechanisms by which structure dissipates damping energy;

the identification and classification of the various types of material and system mechanisms;

the reviews of current research in energy dissipation through interfacial slip at contact surfaces of structure and machine joints;

a method for analyzing systems composed of viscoelastic and elastic materials applied to an elastic plate, along with specific results for a number of damping treatments such as, automotive undercoat, damping tape, and sandwich plates with dissipative cores;

the results of a preliminary experimental study of vibrational energy dissipation at the support junctions of built-in beams and plates;

details of structural damping measurement methods and the limitations that are imposed by the assumptions associated with each method;

a fatigue strength damping criteria for selecting the proper structural materials for the design of members which are subjected to fluctuating resonant stresses;

a hundred references to articles on structural damping, arranged alphabetically according to authors and chronologically for a given author.

This information was prepared by authorities in the field and presented at a colloquium held at the 1959 ASME Annual Meeting.

Paper Binding, 165 Pages $4.25*

SPRAY LITERATURE ABSTRACTS

Here, for the first time, is a comprehensive source-book on the multitudinous applications of sprays and their scientific, technical and industrial aspects. The compilation comprises over 1300 items collected from the technical literature of 24 countries, published from 1880 to 1958 inclusive. The abstracts are detailed, contain full bibliographic data, as well as information on the affiliation of each author wherever available. Entries include:

fuel sprays for furnaces, internal combustion engines, gas turbines, and rockets;

sprays in industrial processes for evaporation, drying, humidification, cooling, air conditioning, and chemical reactions;

atmospheric sprays, as rain, fog, haze, sleet and snow, their formation, evaporation and freezing;

agricultural sprays for sprinkling, pest, fungus, and weed control;

fire-fighting sprays, as in sprinkler systems and in fire-smothering fogs;

aerosols for medical, disinfecting, therapeutic, and air conditioning purposes;

sprays and fogs for military purposes in defense and attack.

Other entries direct attention to published information having a bearing on the theoretical and experimental study of sprays; in particular:

mathematics, ranging from arithmetics to statistics and probability theory;

physics and chemistry, dealing with the properties of liquids and gases, especially the science of colloids and other disperse systems;

hydro-, aero-, and thermodynamics, and rheology, dealing with the motion of liquids in spray-generating devices, the breakup of liquid stream into drops, and their motion in air, their evaporation and combustion;

optical and electronic devices for the experimental study of sprays;

branches of mechanical and production engineering concerned with the design, production, and testing of pumps, nozzles, and other elements of spray generating equipment;

borderline and associated disciplines, such as the science and technology of powders and dusts.

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ASA Y15.1–1959 $2.00*

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MECHANICAL TEST

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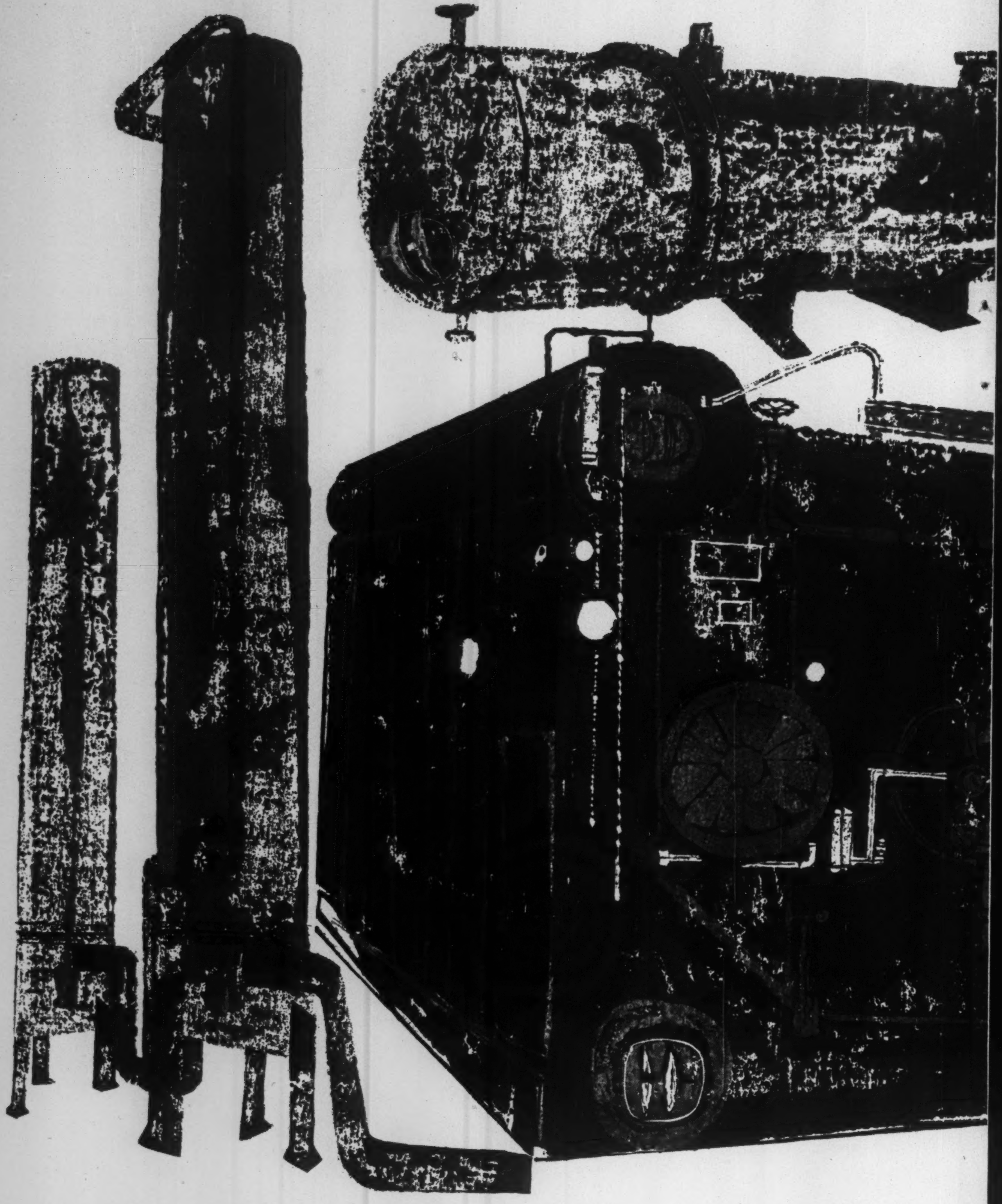

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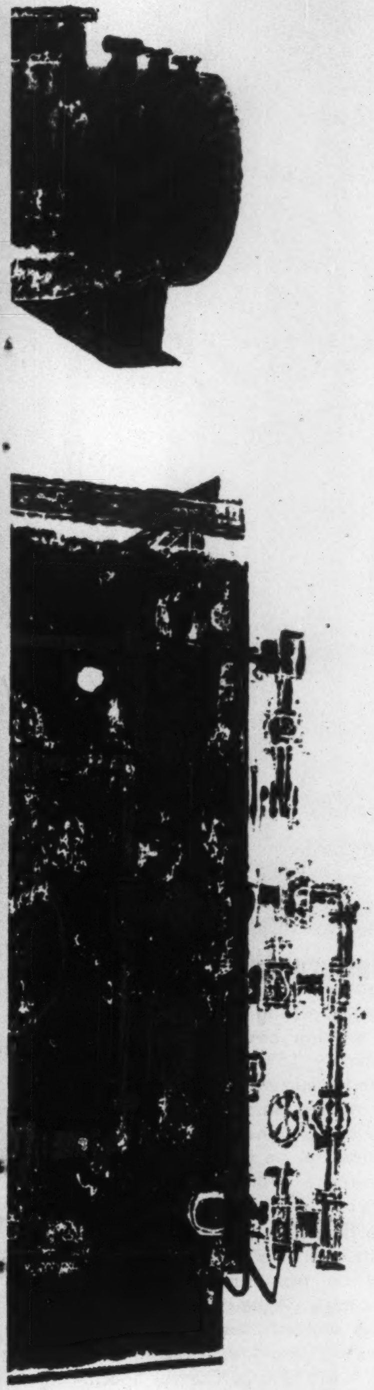

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At Foster Wheeler *extra thoroughness* is standard procedure. FW engineers are more than just designers and builders of equipment. They are also men with experience in the overall application, operation and servicing of power plant equipment. In knowing a little more about the whole plant, they are better able to produce efficient, rugged, easy-to-operate equipment.

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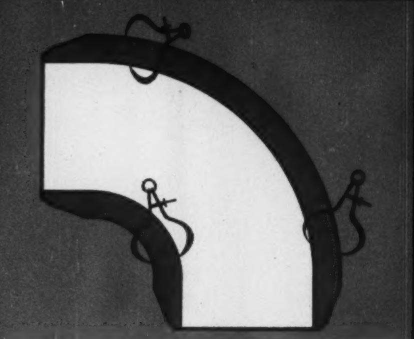

Uniform Wall Elbows

Key-Kast **Long Tangent** Elbows have uniform cast steel walls approximately 15% heavier than the required minimum thickness of pipe walls of the same I.D. For extra highly stressed line sections, the wall thickness can be increased as much as desired — without sacrificing uniformity.

The flexibility of Key-Kast Elbows permits their use in piping systems based on the usual piping stress calculations. Write for engineering bulletin entitled "Key-Kast Welding Elbows in Piping Stress Calculations," for W-K-M's Quality Control Specifications No. 102958 (conventional steam power) and No. 103058 (nuclear power).

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KEY-KAST *Long Tangent* Welding Elbows will give you outstanding service in any high pressure, high temperature alloy piping system. They are the *only* long tangent elbows with cast steel walls of uniform thickness and strength. Nipples and extra welding are eliminated — long tangents can be provided at either or both ends.

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Call your Key-Kast representative for prompt, experienced service in selecting the Key-Kast *Long Tangent* Elbow best for you. Available in all standard sizes and schedules with tangent lengths as long as half the O.D. of the connecting pipe . . . and specially designed to meet specific conditions of pressure, temperature and lading.

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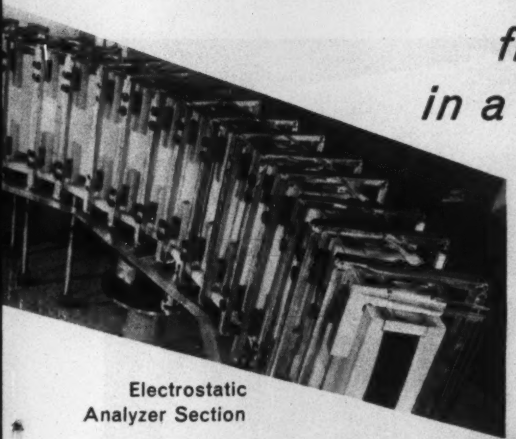
finding the needle in a nuclear haystack



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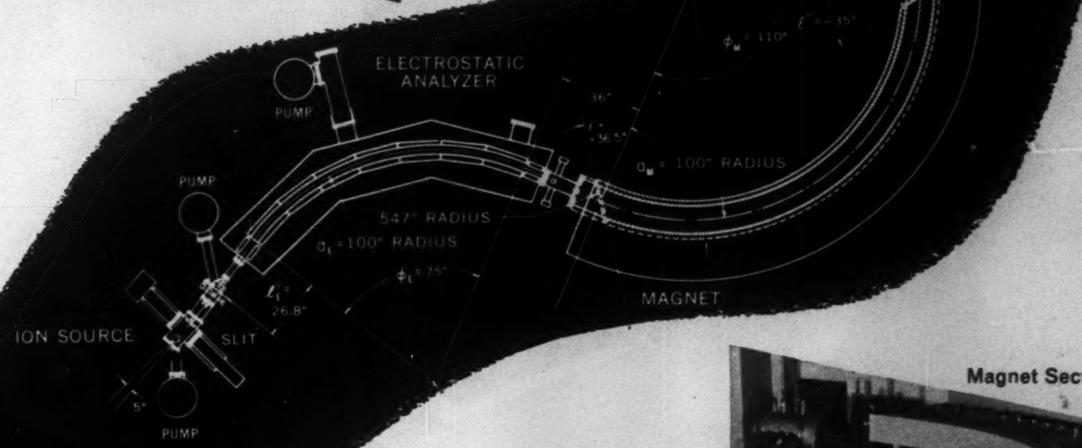
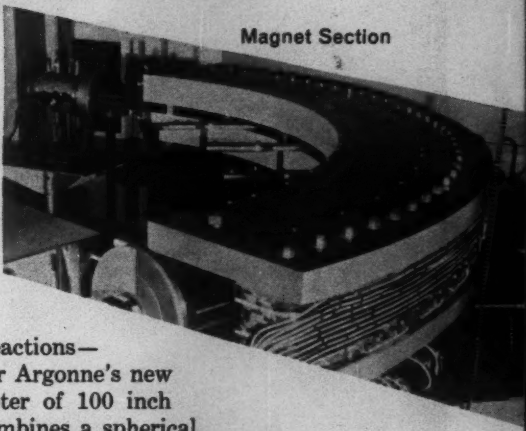
100 INCH RADIUS
DOUBLE FOCUSING
MASS SPECTROMETER


ION DETECTOR
SLIT
$\ell_M'' = 24.5''$
$\varepsilon'' = -35°$
$\phi_M = 110°$
ELECTROSTATIC ANALYZER
PUMP
36°
$\varepsilon' = +36.5°$
a_M = 100" RADIUS
PUMP
547" RADIUS
a_E = 100" RADIUS
$\phi_E = 75°$
$\ell_E' =$ 26.8"
MAGNET
ION SOURCE
SLIT
5°
PUMP



Magnet Section

The search for a rare heavy isotope, Cm^{247} in nature; determination of spallation products from high-energy nuclear reactions—These are typical analytical problems for Argonne's new double focusing mass spectrometer of 100 inch radius. This huge instrument combines a spherical electrostatic analyzer and a magnetic analyzer in the Mattauch-Herzog arrangement to produce focusing of the ion beam both in direction and in velocity. High transmission and high resolution are achieved simultaneously. The mass spectrometer has been designed to transmit more than 95 per cent of the ions produced in a conventional ionization source with a resolution of 10,000. Specialized equipment and services available at Argonne were required for building this unique research tool. There are unusual opportunities here for those who would create and use such instruments.

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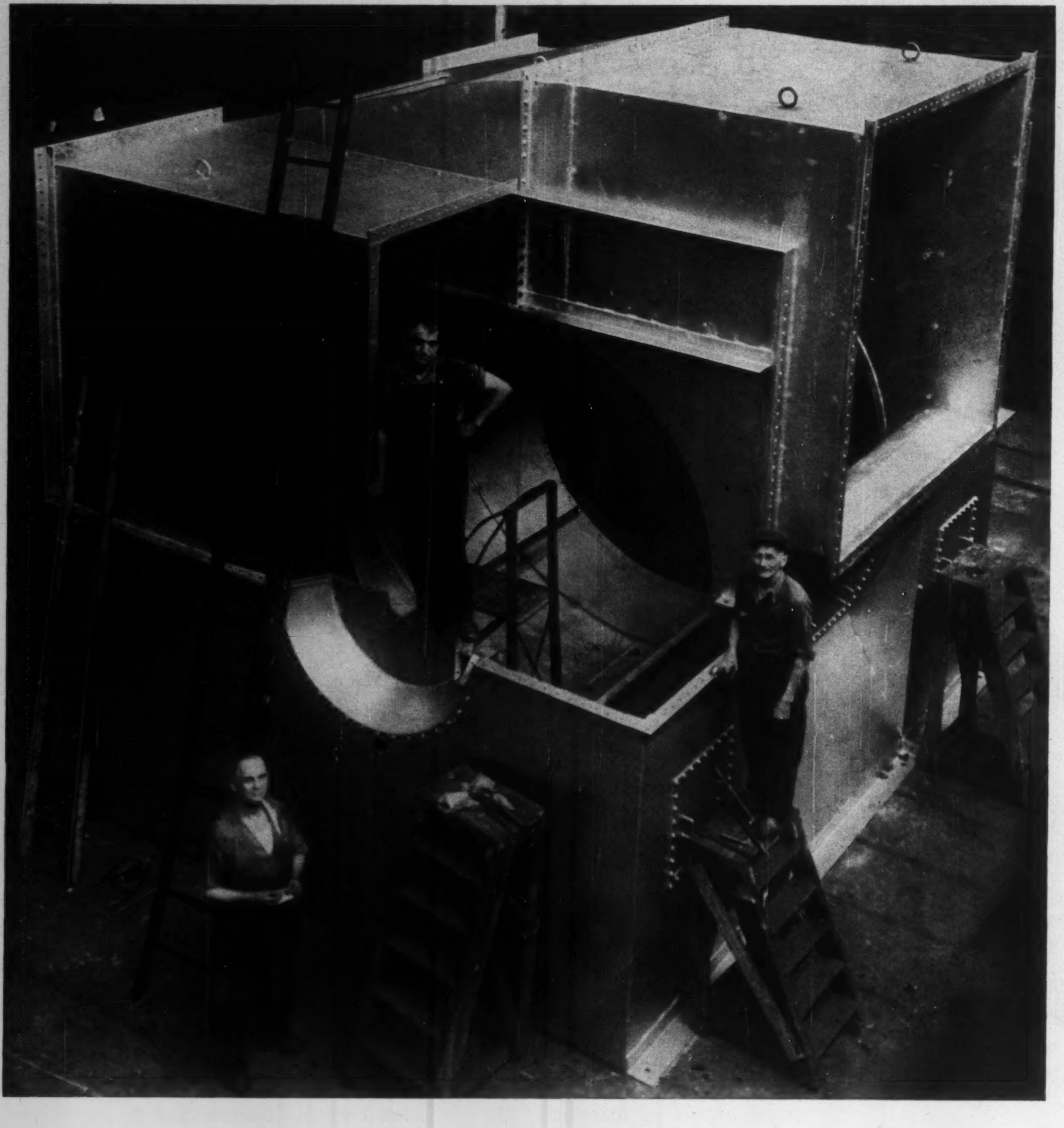
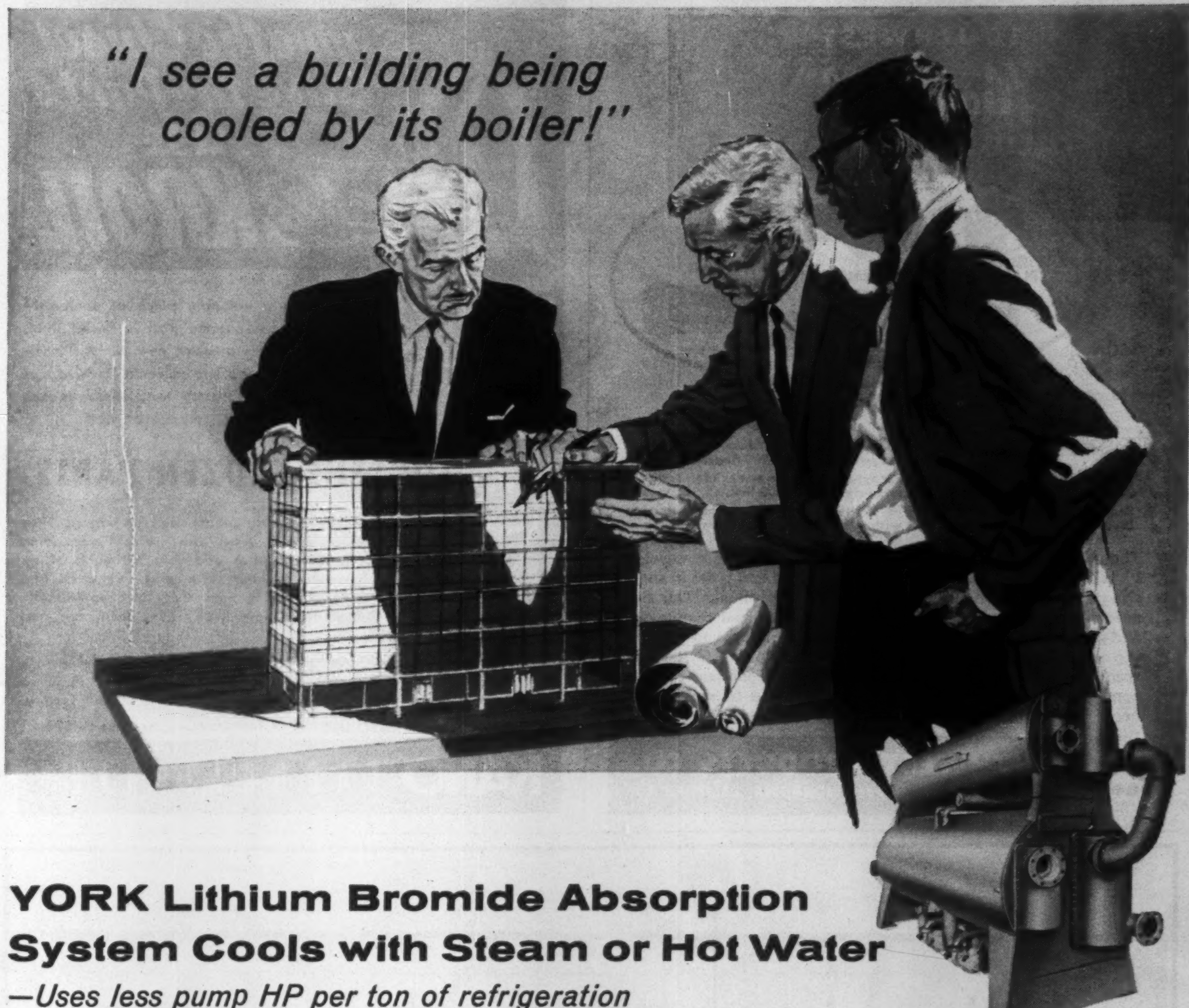


You wouldn't buy a bargain basement parachute... or a cut-rate big game rifle...

Don't choose less than Clarage quality for your mechanical draft service. With anything as vital as uninterrupted operation, it pays big dividends to get the best in equipment. Clarage, a specialist in building forced and induced draft fans, offers you equipment having a long-standing reputation for long-lasting service. CLARAGE FAN COMPANY, Kalamazoo, Michigan.


"I see a building being cooled by its boiler!"

YORK Lithium Bromide Absorption System Cools with Steam or Hot Water

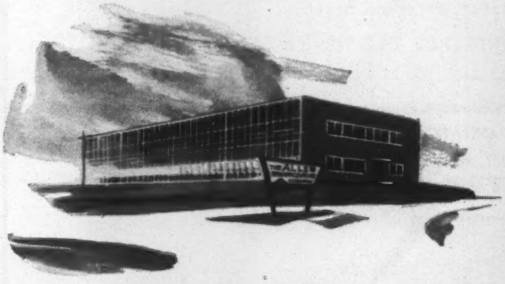
—Uses less pump HP per ton of refrigeration

CAN UTILIZE EXCESS BOILER CAPACITY—Unique system uses existing steam or hot water for economical cooling. Can cut operating costs up to 25% over ordinary motor-driven compressor systems. Refrigerant is plain water, absorbent is lithium bromide.

MORE EFFICIENT FLUID DISTRIBUTION—Advanced method of liquid flow cuts pump horsepower and reduces power costs. It also assures quieter operation, rapid start-up, close control. Fluids are non-toxic, non-explosive, never need replacement.

LOWER INSTALLATION COST—No expensive starters or heavy electrical conduit. Noiseless, vibration-free operation permits installation anywhere from basement to roof without costly foundations. Roof-top location saves piping and pipe shafts.

VIRTUALLY MAINTENANCE-FREE—Except for 3 small pumps and motors, the unit has no moving parts. Operates automatically, easily handles load changes. Steam valve provides simple, direct capacity control. 100 to 740 tons refrigeration.



Another YORK Trail Blazer Concept Proved in Action at *Allen Mfg. Co., Bloomfield, Conn.*—Excess boiler capacity in summer is used to deliver very economical cooling. A 230-ton York Absorption System air conditions the office and cafeteria, and a 170-ton unit chills process water.

YORK

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YORK BW DIVISION

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Air Conditioning, Heating, Refrigeration and Ice-Making Equipment • Products for Home, Commercial and Industrial Applications

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CHARACTERISTICS

ANALYSIS	RECOMMENDED USE
① Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
② Chrome Alloy Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
③ Bronze Race and Chrome Steel Ball	For types operating under normal loads with minimum friction requirements.

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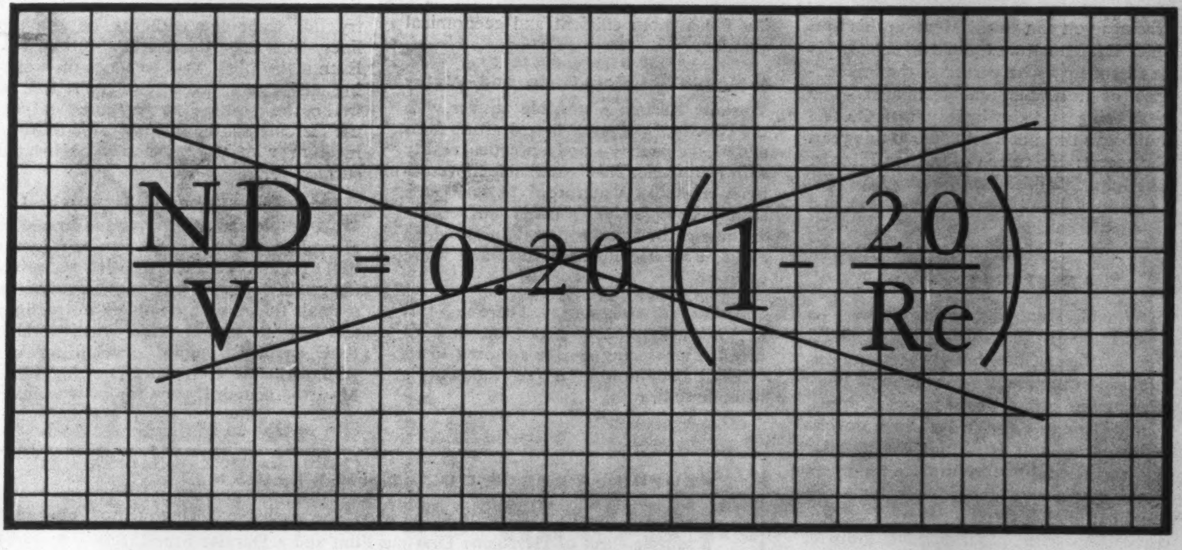

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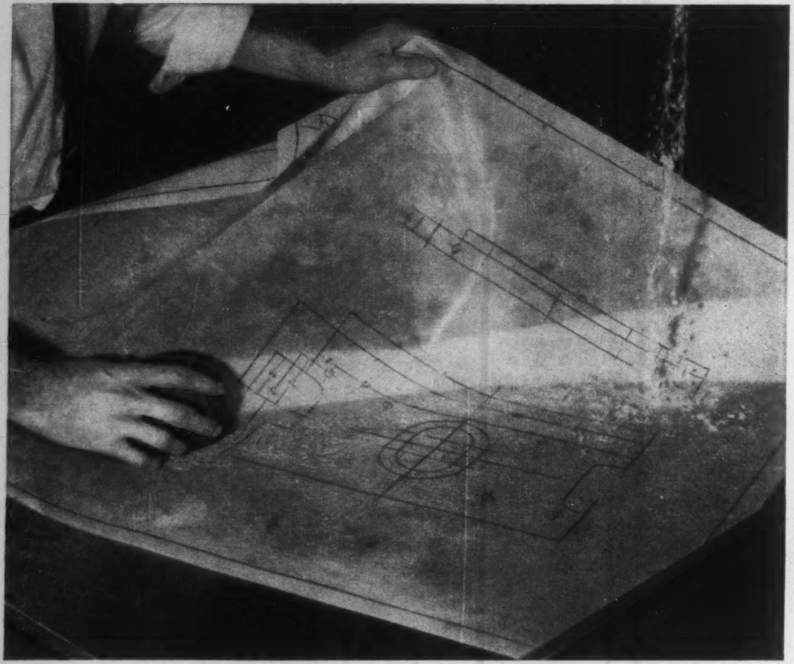

This badly-soiled drawing is getting a mild soap-and-water bath to restore its original printing quality.

Tracings you can wash! Mention this to a Chief Draftsman and you'd likely see his eyes light up as he perceives the implications of a simple new technique – one that's being used now by Raytheon Co. and could save them at least $50,000 this year. The secret: Herculene® Drafting Film by K&E, plus Staedtler Duralar plastic pencils – a completely washable combination, and the answer to . . .

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Washing became a possible answer with the advent of polyester-base drafting films and plastic pencils – and a practical reality with Herculene. This remarkable film combines a stable, waterproof Mylar® base with a completely washable surface for smudge-proof Duralar pencil lines – which *bond* to the Herculene surface and won't wash off.

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December, 1959 **CARD INDEX** **Vol. 81, No. 12**

Obligations of an Engineer, G. B. Warren 50
The Tilt-Wing Propelloplane, J. B. Nichols 52
Small, Free-Piston Engine Compressor, J. H. McNinch, W. W. Vogelhuber and R. J. McCrory 57
Mechanical Power Transmission
  Belts, Chains, and Gears, E. S. Cheaney, C. L. Paullus, and W. C. Raridan 61
  Clutch—Fluid Coupling—Hydraulic Torque Converter, R. W. Bachmann
A Model Law for Professional Engineers, W. H. Larkin 70
Design Study of a 300-MW Organic-Cooled Reactor, R. Balent, G. H. Bosworth, and J. Plawchan 72
Editorial 49
Briefing the Record 78
Photo Briefs 90
European Survey 92
ASME Technical Digest 94
Comments on Papers 106
Reviews of Books 107
Books Received in Library 108
The Roundup 112
The ASME News 127

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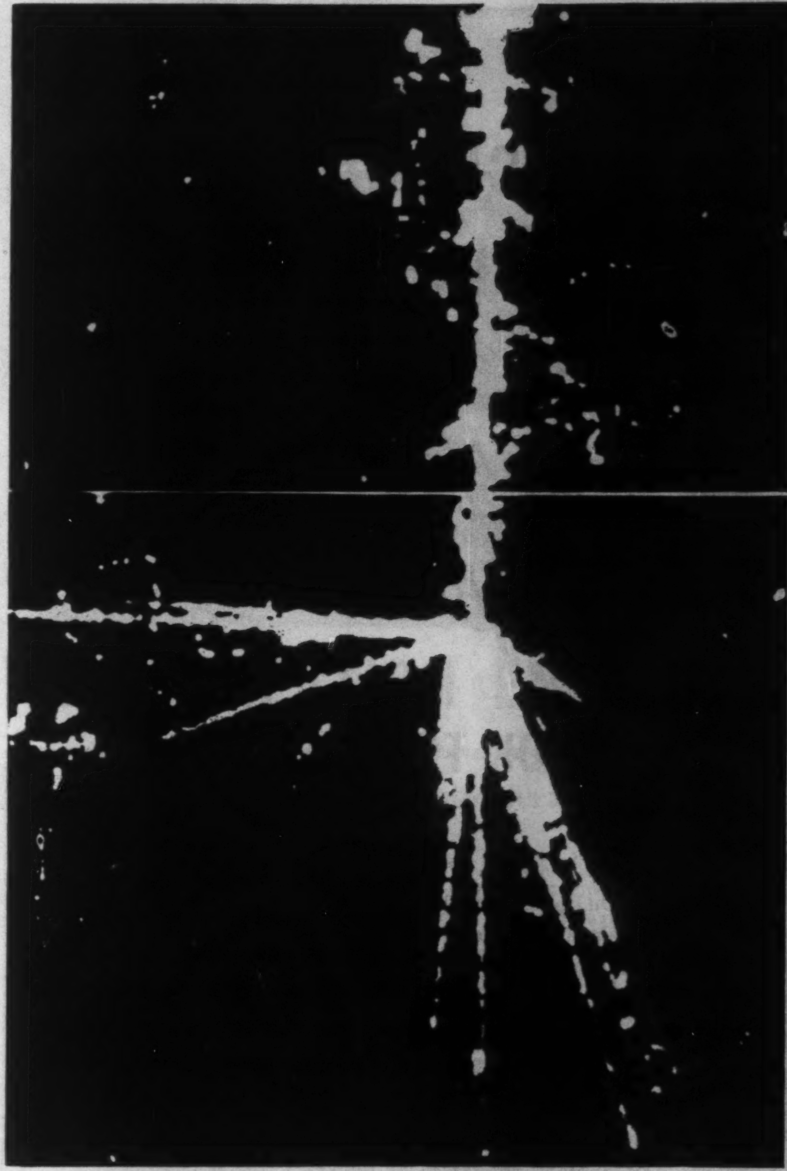

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An informative advertisement from one of the nation's most experienced condenser manufacturers

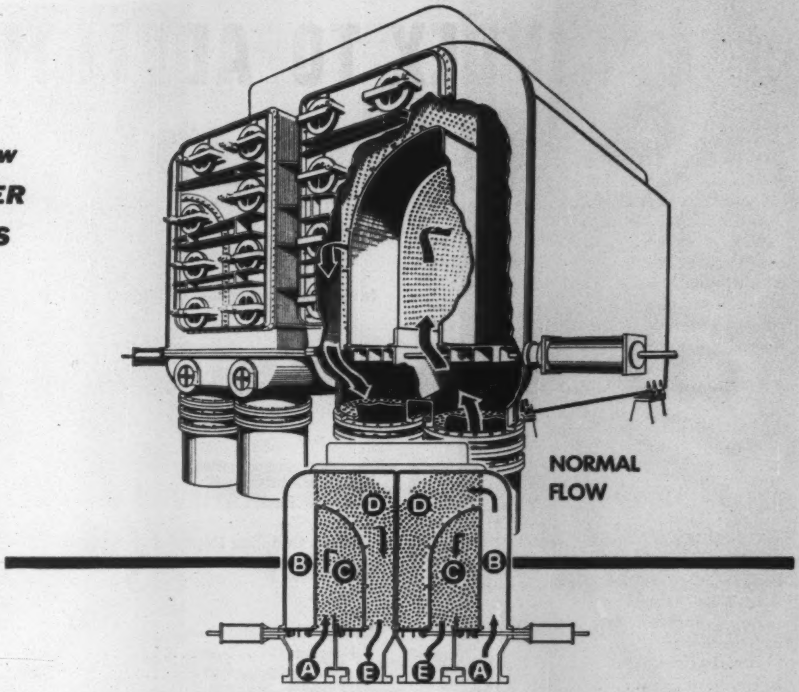

Fig. 1: Simplified diagram showing how Reverse Flow cleans tubes and sheets during full load operation.

Since a major condenser maintenance problem is caused by foreign matter, algae and scale which clog tubes and sheets, there is a constant search for better ways to remove this contamination. One of the most successful methods is Reverse Flow (see diagram on right), a system of back-flushing tubes and sheets without shutting down the condenser.

This Reverse Flow design, patented by C. H. Wheeler Manufacturing Company, designer and builder of steam condensers since 1903, has proved itself in installations throughout the world. Here's how it works:

Normal operation is shown on the left. Water enters through inlet A with inside port open, flows through tube bank C to the rear of the condenser. It returns through tube bank D to the front of the condenser and discharges at E.

The right side of the diagram above shows Reverse Flow in operation in a C. H. Wheeler Dual Bank, Divided Water Box Condenser. Water enters through A with outside port open, flows up through channel B and through tube bank D to rear of condenser, returns through tube bank C to front of condenser and discharges at E. Reversing can be accomplished during full load operation and full flow of circulating water, without additional pressure loss. Sluice gates for each half of the condenser move on a common stem. Each half of the condenser can be back-flushed independently; or both halves can be back-flushed simultaneously with one or two circulating pumps operating.

Other Ways To Keep Tubes Clean

Special slugs are sometimes used to remove algae and foreign matter from the insides of condenser tubes. They're forced through the tubes by high-pressure water; thus scale and other contamination is flushed as it's dislodged. When the slugs are metal, care must be taken to prevent ruining them as they fly from the outlet side of the tubes.

Sometimes a 5% HCl solution is introduced into the tubes to dissolve the scale. While this method is effective, it is often necessary to leave the acid in the tubes for six hours or so—thus prolonging down time. Also, it's necessary to flush the tubes before the condenser can be put back in service.

In general, maintenance becomes more of a problem as water-source pollution increases; also as circulating water temperature rises, because the rate of scale formation increases at higher water temperatures.

Solving Deaeration Problems

Oxygen and other non-condensable vapors in the condensate result from leaks or are introduced through make-up water or heater returns. Most authorities believe that the greatest source of oxygen is make-up water.

Make-up water which is not properly heated in the condenser and agitated sufficiently to release entrained gases results in excessive oxygen and other non-condensables in the condensate. As a consequence, corrosive oxides may be deposited in the boiler, reducing its efficiency.

Proper distribution of normal make-up water is achieved in Wheeler condensers by spraying it over the top of the tube banks at both ends of the tubes, and out of the path of high-velocity steam from the turbine exhaust. Steel bars above tubes protect them from water impingement damage.

Heater returns are sprayed in the steam lanes to permit flashing and distribution of the returns and release of entrained gases.

All condensate draining off the tubes is cascaded over a series of horizontal deaerating bars (1, Fig. 3) in the presence of a moving blanket of steam to provide greater agitation and reheating before condensate is drained into the hotwell.

Fig. 2: A few of the types of slugs used to clean the inside of condenser tubes.

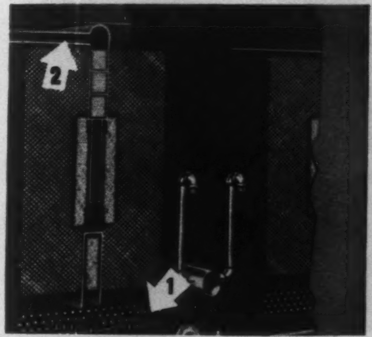

Fig. 3: Drawing of deaerating bars and air-vapor suction line. Tubejet® Air Ejector.

Notice too, location of the air-vapor suction line (2), through which the Tubejet® Ejector draws off non-condensable gases and discharges them to the atmosphere.

In C. H. Wheeler Dual Bank Divided Water Box Condensers the air cooler section is centrally located, so as to reduce depth of steam penetration and consequently resistance to steam passage, achieving a new low in pressure loss in the condenser.

If you have a maintenance problem that doesn't seem to improve no matter what you do, C. H. Wheeler may be able to help. Get in touch with a Wheeler representative or write direct. No obligation.

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INDEX TO ADVERTISERS

AC-Electronics Div.
  General Motors Corp.............. 2
ACF Industries (Inc.)
  W-K-M Division.............. 168
Air Products (Inc.).............. 182
Alco Products (Inc.).............. 175
Allied Metal Hose Co.............. 152
*Allis-Chalmers Mfg. Co.............. 176
ASME Publications..............144, 164
Argonne National Lab.............. 169
Avco-Everett Research Lab.............. 17

*Babcock & Wilcox Co.
  Boiler Div..............2nd Cover
  Tubular Products Div.,
    Fittings Dept.............. 4
Bonney Forge & Tool Works.............. 147
*Borg-Warner Corp.
  Roy C. Ingersoll Research Center.. 177
*Buffalo Pumps
  Div. Buffalo Forge Co.............. 187
Byers, A. M., Co.............. 21

*Carrier Conveyor Corp.............. 10
*Chicago Bridge & Iron Co.............. 23
Clarage Fan Co.............. 170
Clearprint Paper Co.............. 1
*Combustion Engineering (Inc.)......14, 15
Consolidated Electrodynamics Corp. 163
Consolidated Western Steel
  Div. of United States Steel Corp... 178

Dresser Industries (Inc.)
  Roots-Connersville Blower Div.... 11
du Pont, E. I., de Nemours & Co..... 180

*Elliott Company
  Div. of Carrier Corp.............. 178

Fiske Bros. Refining Co.
  Lubriplate Div.............. 150
*Fly Ash Arrestor Corp.............. 145
*Foster Wheeler Corp..............166, 167
Fulton Sylphon Div.
  Robertshaw-Fulton Controls Co... 146

*Gear Specialties (Inc.).............. 6
General Atomic
  Div. of General Dynamics.............. 8, 9
General Electric Co.............. 177
General Motors Research Labs.............. 12
*Golden Anderson Valve Specialty Co. 158
Green Fuel Economizer Co.............. 18

Hamilton Standard
  Div. United Aircraft Corp.............. 180

International Business Machines.... 183

Jenkins Bros.............. 140

Kano Laboratories.............. 172
Keuffel & Esser Co.............. 174
Koppers Co.
  Fast's Coupling Dept.............. 16

Lenape Hydraulic Pressing &
  Forging Co.............. 154
Los Alamos Scientific Lab.............. 179
Lovejoy Flexible Coupling Co.............. 160
Lubriplate Div.
  Fiske Bros. Refining Co.............. 150
Lukens Steel Co.............. 19
Lunkenheimer Co..............3rd Cover

McDonnell & Miller (Inc.).............. 149

Martin Co.............. 165

National Cash Register Co.............. 176
Niagara Blower Co.............. 162

Oldsmobile Div.
  General Motors Corp.............. 188

*Pangborn Corp.............. 151
*Patterson-Kelley Co.............. 20
*Posey Iron Works.............. 162
Powell, William, Co.............. 13
Pulp and Paper Research
  Centre (Inc.).............. 175
Pulsation Controls Corp.............. 163

Raybestos-Manhattan (Inc.)
  Packing Div..............142, 143
Robertshaw-Fulton Controls Co.
  Fulton Sylphon Div.............. 146
Rockford Clutch Div.
  Borg-Warner.............. 159
Roots-Connersville Blower Div.
  Dresser Industries (Inc.).............. 11

Sly, W. W., Mfg. Co.............. 153
*Southwest Products Co.............. 172
*Syntron Co.............. 157

Texas Instruments (Inc.).............. 181
Thomas Flexible Coupling Co.............. 150
Timken Roller Bearing Co.......4th Cover

United States Graphite Co.
  Div. Wickes Corp.............. 7
*United States Steel Co.............. 178

*Vogt, Henry, Machine Co.............. 22

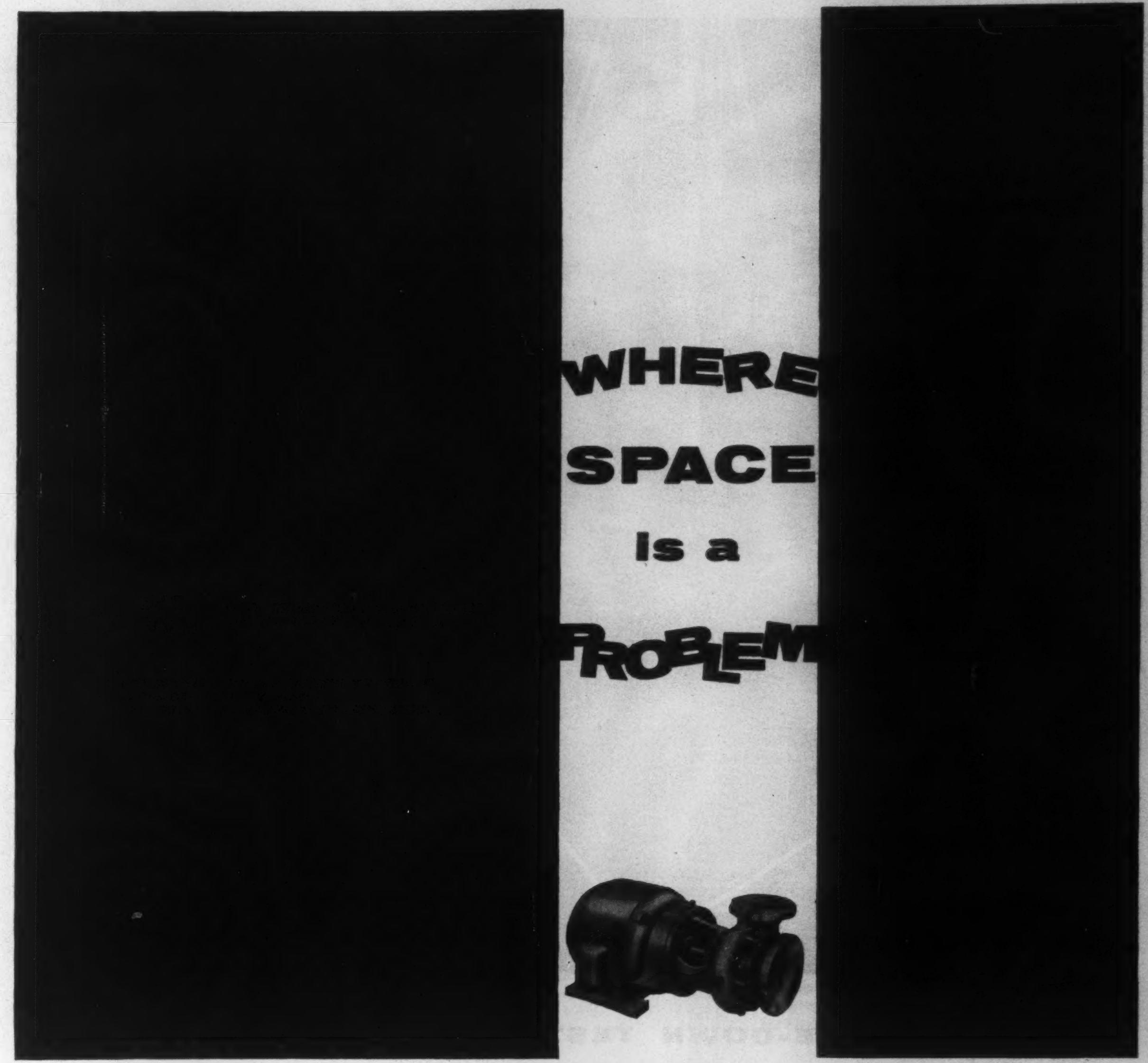
W-K-M Div. of ACF Industries (Inc.) 168
*Westinghouse Electric Corp.
  Atomic Power Dept.............. 148
  Bettis Atomic Power Lab.............. 173
*Wheeler, C. H., Mfg. Co.............. 185
*Wickes Boiler Co.
  Div. Wickes Corp.............. 161
Williams Gauge Co.............. 152

*Yarnall-Waring Co.............. 139
Yoder Co.............. 160
York Corp.
  Sub. Borg-Warner Corp.............. 171
*Yuba Consolidated Industries (Inc.)
  Adsco Div.............. 24

***** The asterisk indicates that firm has product catalog in the 1960 Mechanical Catalog.

Your attention is directed to

Keep Informed Section.......141–163
Consulting Service.............. 184
Opportunities..............175–183
Engrg. Soc. Personnel Service... 135
(Agency)



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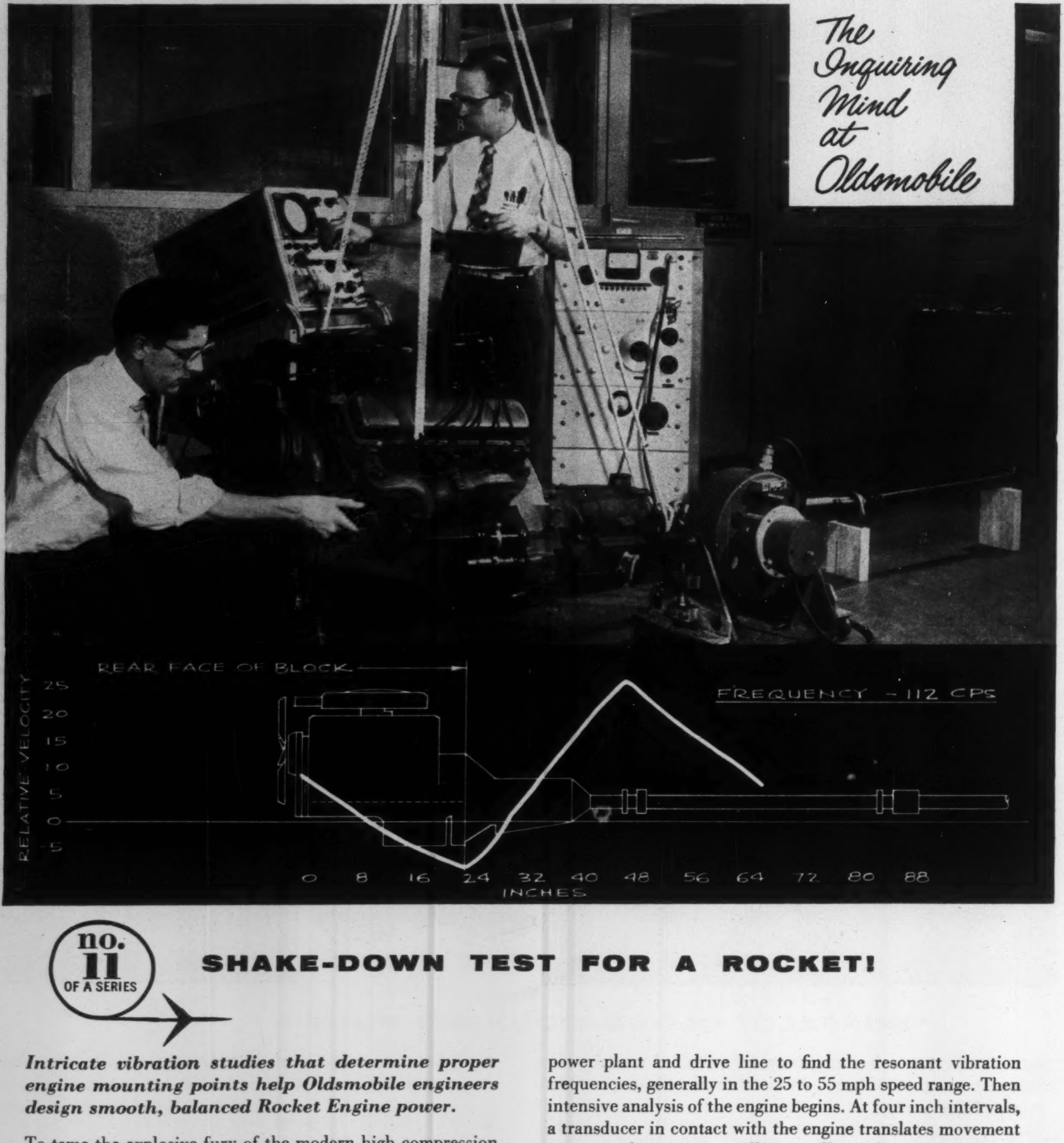

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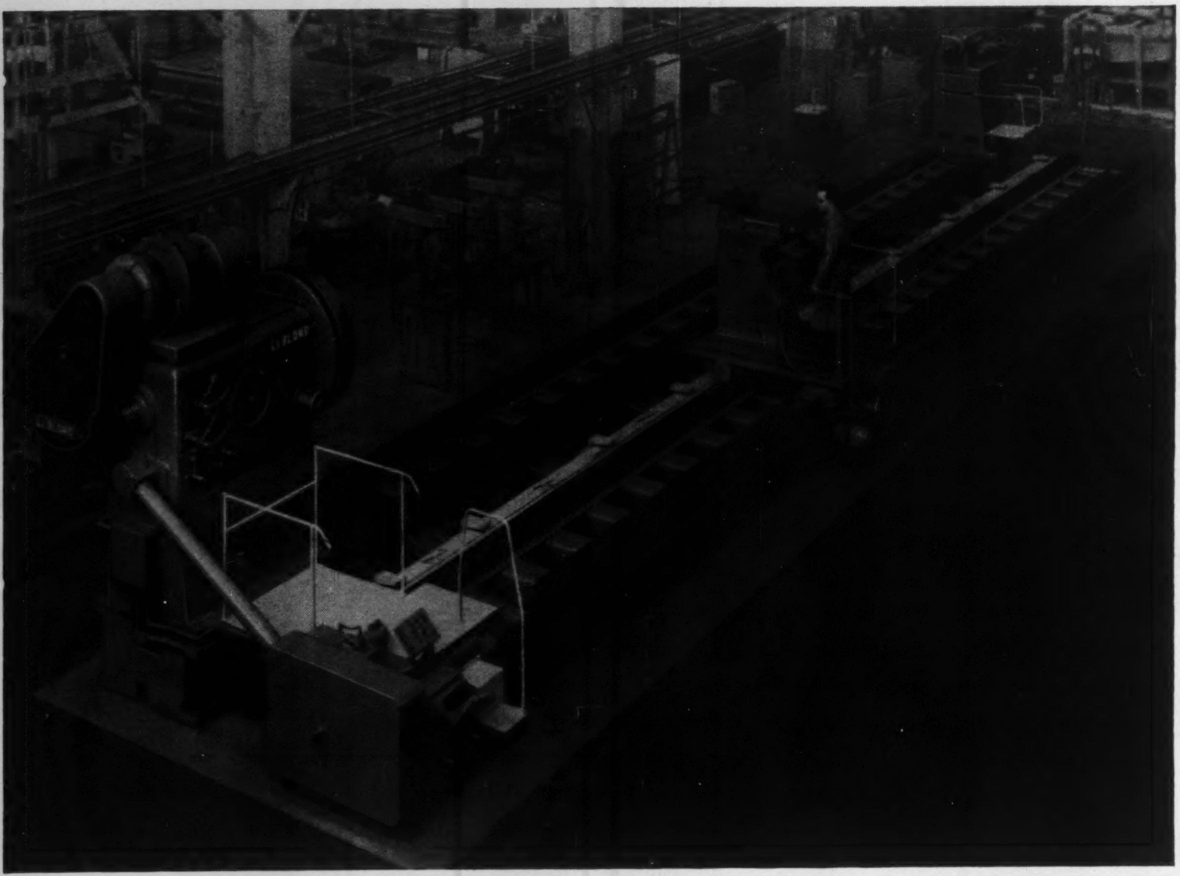

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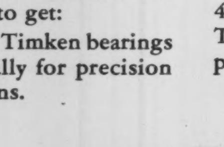

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MECHANICAL ENGINEERING, JANUARY, 1960, VOL. 82, NO. 1 ISSUED IN TWO SECTIONS. SECTION TWO. REPORT OF THE COUNCIL TO THE MEMBERS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE
AMERICAN
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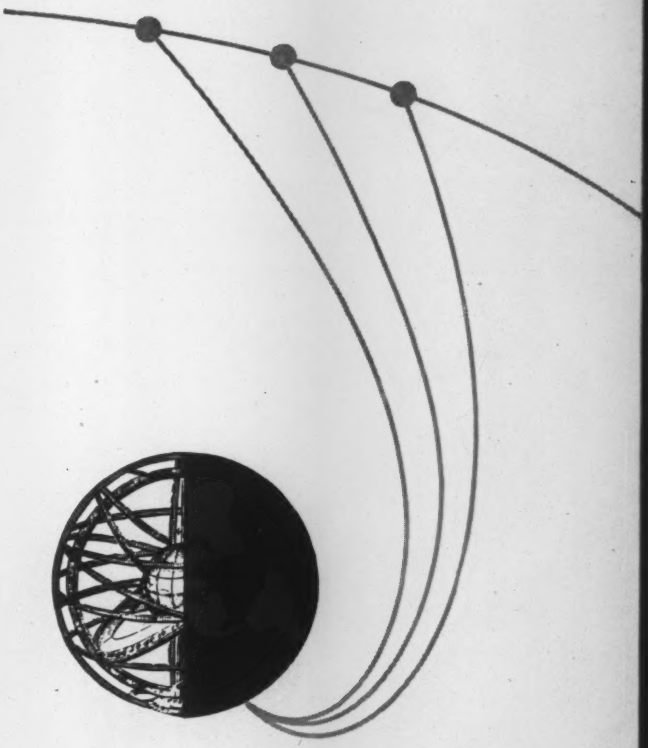
OF
MECHANICAL
ENGINEERS

ANNUAL
REPORT

Covering fiscal year
October 1, 1958
September 30, 1959



ENGINEERING IN A WORLD OF CHANGE

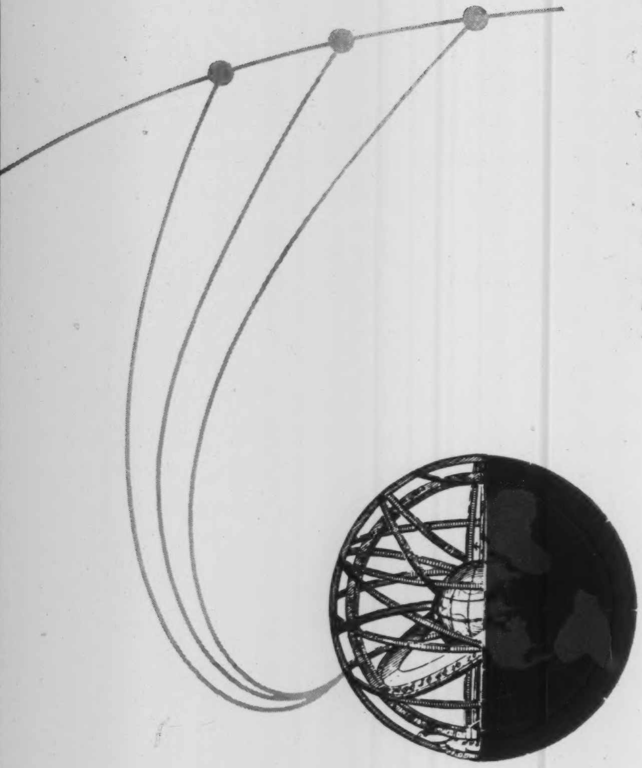
The 58,000 members of The American Society of Mechanical Engineers belong to one of the world's leading technical organizations. Founded in 1880, the Society exerts a major influence in the selection and dissemination of technical information in all fields of mechanical engineering

ENGINEERING IN A WORLD

and in stimulating the development of individual engineers and the engineering profession.
The members of the Society on the North American continent are organized into 92 Sections in the United States, Canada, and Mexico. These Sections, in turn, are grouped into eight Regions, each represented by a Vice-President who serves as a member of the Council.

In addition to Sectional and Regional activities, which are largely decentralized and operate in specific geographic areas, the Society carries on many national activities under the direction of the Council. Six major Boards, 24 Professional Divisions and several hundred additional committees and subcommittees are directly responsible for this work, some of which is described in this report.

Helping to execute the policies of the Council is a headquarters staff in New York City of approximately 140 persons, under direct administration of the Secretary.



OF CHANGE

This year, 1959, marks the end of a decade during which the world we live in has undergone a revolution. It is appropriate that we, as engineers, reflect briefly at this time upon these rapid changes in morals, economics, politics and other areas which engineering has, to a large extent, brought about.

The importance of geography, which for centuries dominated relations between nations, has been shrunk almost to insignificance. Today the dreams of engineers, translated into aluminum and steel, span the earth in a few hours or even minutes, carrying goods, people or—ominously—weapons.

Whole philosophies of life have suffered violent impacts, as nations which had been isolated from the rest of the world suddenly found newly engineered communications systems bringing them within range of industrial cultures.

Our concept of speed, within ten years, has changed immeasurably as the word *supersonic* entered every vocabulary.

Even our physical horizons are expanding rapidly. Witness the words that appeared only last year at this time in the Annual Report of ASME. "This was a year when man first succeeded in conquering gravity to send probes into outer space and serious efforts were made to push man-made instruments as far as the moon." This year, of course, man-made instruments have reached the moon and have gone beyond, into orbit around the sun.

From their vantage point on new horizons which they themselves helped to create, engineers are now looking ahead to new frontiers.

These are facts to keep in mind while reading, in the pages that follow, a report on another year's activity by an organization that has contributed so much to the immensely powerful force in today's and tomorrow's world that we call "Engineering."

With satisfaction, the Council of ASME notes the success of many of the Society's efforts during the year and the valuable results these efforts have achieved. With confidence, we look forward to another year of service to the profession and to the larger public that engineering serves.

Three major projects have occupied much of my time as President of ASME during 1959. Because many of the other operations of the Society are covered in detail elsewhere in this report, I feel it may be appropriate for me to use this opportunity to explain the progress, and to some extent the problems, that the year has brought in connection with these three efforts.

In concentrating on these three projects, I intend no slight to the other work of the Society. As in the past, the thousands of members who have carried on essential operations of the Society deserve the greatest credit and appreciation from all of us. I want to take this opportunity to express to them my personal thanks.

IMPORTANCE AND OPPORTUNITIES

The first of these projects has had to do with an effort to emphasize the importance and opportunities of the Professional Divisions, the Research Committes, and the Boards which report to the Council, in relation to the innovative needs of our times. Due to my specific interest and background of experience in several of these areas of activities, I have attempted to point out, at Arden House, at a number of Division Conferences, and at Board meetings, the several directions in which it has seemed to me our work could be made even more effective in meeting the needs of our age. I have met with the most cordial reactions and cooperation in practically all of these efforts and wish to express my appreciation for this.

ENGINEERING UNITY

The second of the projects to which I have devoted a great deal of time has been the Society's continuing effort to encourage a greater degree of cooperatio among the many major engineering societies of this country. This is usually referred to, perhaps unfortunately, as "unity of the engineering profession."

A better description of the plans that most of the engineering societies' leaders have in mind would be "cooperation among engineering societies," or "coordination of professional work." No responsible engineering spokesman feels it would be desirable to dissolve existing groups or to "hamstring" the indispensable work now being conducted by them for their own members. What is strongly felt, and what is, I believe, clearly demonstrable, is that the work of these societies, if it were coordinated in many areas of our activities, could be made much more effective and much more efficient.

The details of the discussions and negotiations that have been conducted by representatives of many groups during the year are too involved to be covered in detail here. It is fair to say, however, that a greater understanding of the need for inter-society cooperation has been generated and that the day of effective coordination of our several efforts has been brought closer.

ENGINEERING CENTER

The third project of overriding concern to me, as ASME President, has been furthering progress on the United Engineering Center. This structure, for

which ground will have been broken by the time this report appears in print, will be erected opposite the United Nations Building in Manhattan. The new 12 million dollar building will house the headquarters of the five Founder Societies who will, through the United Engineering Trustees, own the building. Fourteen other engineering societies and related organizations, including the Engineering Societies Library, will occupy space in the Center.

Our Society, of course, has had more than a passive role in the erection of this Center. We have assumed the obligation of raising $800,000 in gifts as our share of financial support. At the end of fiscal 1957, one year ago, ASME had achieved 28 per cent of its quota. At the same time this year ASME had achieved 71 per cent of its quota. At first this might seem like slow progress or an indication that ASME members are not enthusiastic in their support of the Center. Analysis of the records, however, tells a different story.

In each Section where fund-raising committees were active, ASME members have responded more than generously. Many Sections have exceeded their quotas by 50 per cent or more. Our problem, it seems, is largely administrative. Because of the far-flung geographic structure of the Society, and particularly because this is acute in several of the larger Sections, it has not been an easy task to establish in each area an active and effective fund-raising committee. One by one, however, leaders in these areas are assuming the task and are proceeding. I, as President and a member of the Council of the Society, have no doubt whatever that the Society will fulfill its obligation.

I am confident, too, that the United Engineering Center, and the engineering groups it is to house, will remain in the future a symbol of the creativity and selflessness of the members of a great profession.

FINANCIAL CONDITION

In passing, I would like to comment, too, on the financial condition of the Society. Due to the slight business recession of 1958 and early 1959, our Society found it necessary to budget a slight loss for the 1959 fiscal year. Fortunately, due to the excellent judgment on the part of several Boards, notably in improving our *Transactions* publications policies, and to the diligent work of all members of the staff, we were able to increase our income and hold down our expenditures. As a result of these efforts, the year end result shows a slight net operating surplus rather than the budgeted deficit.

Once again, I want to express my thanks to the thousands of people who contributed to whatever successes were achieved during my term of office, particularly to our Regional Vice Presidents and their Regional and Sectional associates, our members of Council, the hundreds of hard-working committee members, and to our excellent staff, all of whom have helped to make this year a satisfying and pleasant experience.

Sincerely,

Glenn B Warren

A MESSAGE FROM THE PRESIDENT

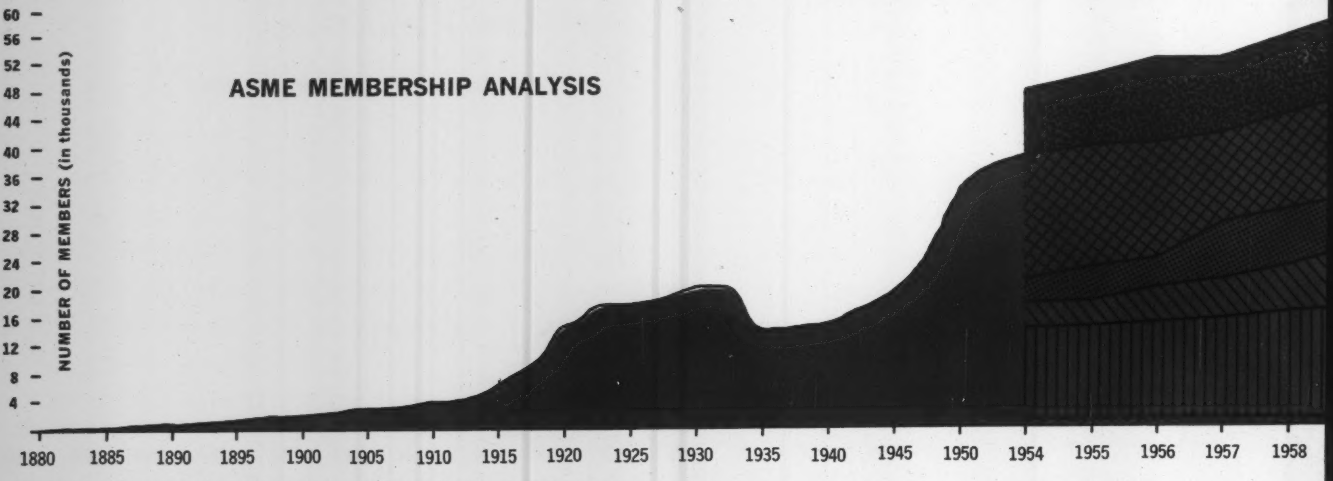
HIGHLIGHTS

Membership in ASME during 1959 reached an all time high. Including Student Members, the total on September 30 was 58,421, reflecting, in particular, increases in the number of Associate Members. A detailed analysis of membership appears below.

By opening its meetings and conferences to members of many other engineering groups, ASME this year took a step toward unity of the engineering profession. A member of any Society with representation on Engineers' Council for Professional Development or Engineers Joint Council, as well as certain other groups, may now attend ASME meetings and conferences on the same basis as an ASME member.

In order to provide improved service at national, general meetings of the Society, steps have been taken during the year to modify the format of the Annual and Semi-Annual Meetings.

Continuing its policy of streamlining meetings and conferences to make them more useful to members, the Society also took steps to more evenly balance the size of ASME's two general meetings. This move was dictated by the growing size, and conse-



Note—The above figures are, with few exceptions, as of Sept. 30th each year.

quent unwieldiness, of recent Annual Meetings.

In addition, there was further progress in the effort to reduce the number of technical conferences by encouraging joint sponsorship and amalgamation.

Work initiated three and four years ago began to bear fruit this year as the total number of new and revised standards published by the Society swung sharply upward. Thirty-two codes and standards were published this year.

Three new Sections were added to the roster of ASME's geographic units during the year, swelling the total to 92. The three, Central Virginia, Eastern Virginia and Northern New Jersey, reached autonomous status after varying periods as Sub-Sections. Meanwhile five new Sub-Sections were formed: Paducah, Kentucky; San Antonio, Texas; Ohio Valley; Oak Ridge, Tennessee, and Idaho.

Four new publications launched during the year, the *Journals of Heat Transfer, Basic Engineering, Engineering for Industry* and *Engineering for Power,* complementing the *Journal of Applied Mechanics,* met with instant acceptance. In dollar volume, subscription income to ASME from these publications has risen to $115,000, double that of the older form of *Transactions of the ASME.* At the same time, costs to both the Society and to subscribers have decreased, since subscribers may now receive only the quarterlies of interest to them, rather than the full *Transactions.*

The first year of ASME's medical group insurance plan proved highly successful. By October, nearly 3000 applications had been received. All categories of Society members are participating, in approximately the same ratio as their grade of membership in ASME. Many of the members employed by large companies have joined, apparently feeling that the supplementary coverage is helpful.

About 200 claims have been paid, according to the plan administrators, Smith, Sternau and Son, of Washington, D. C.

An option which went into effect September 1, 1959, permitted members covered by various limited plans to avoid paying for duplicated coverage in the Senior Hospital Nurse Surgical Plan.

CHANGES IN MEMBERSHIP Oct. 1, 1958 to Sept. 30, 1959

	MEMBERSHIP		INCREASES			DECREASES				CHANGES		
	Sept. 30 1959	Sept. 30 1958*	Transferred to	Elected	Reinstated	Transferred from	Resigned	Dropped	Died	Increases	Decreases	Net Change
Honorary	75	74	1	1					1	2	1	+1
Fellows	451	433	36						18	36	18	+18
Members	16697	16181	455	537	141	37	179	206	195	1133	617	+516
Affiliates	275	283		5	4		8	4	5	9	17	−8
Associate Members ($25)	8365	6770	1997	158	140	198	120	369	13	2295	700	+1595
Associate Members ($20)	6609	7701	1808	139	35	2197	178	697	2	1982	3074	−1092
Associate Members ($10)	14332	13372	3916	427	67	1865	292	1277	16	4410	3450	+960
Subtotal	46804	44814	8213	1267	387	4297	777	2553	250	9867	7877	+1990
Student Members	11617	11732		3801		3916				3801	3916	−115
Grand Total	58421	56546	8213	5068	387	8213	777	2553	250	13668	11793	+1875

***Adjusted to reflect new tabulating procedure.**

NATIONAL MEETINGS & CONFERENCES

In line with the Society's policy of giving its members more information in less time, efforts were made this year to simplify and speed up procedures at all meetings and cut down the number of conferences.

A coordinating committee, with representation from the Meetings Committee and the Professional Divisions Planning Committee, was established this year to screen plans for future conferences, determine where conflicts lie and to encourage, wherever possible, joint conferences among ASME Divisions and with other societies.

Twenty-seven fewer sessions were scheduled for the 1959 Annual Meeting, as compared to last year's. A new rule that technical programs for the Annual Meeting must be received at headquarters two months earlier than ever before also went into effect. In this way, it is hoped that more papers will be printed in advance of the meeting.

A new method of distributing papers, first tried at last year's Annual Meeting, proved popular and will be continued.

As a result of a new Society policy for most ASME conferences, a member attending may use the free coupons he receives each year to defray all or part of the registration fee, which is usually $2.00. In most cases the conference fee entitles the registrant to copies of any five available papers.

To aid committees in planning their conferences, a newly revised copy of the Meetings and Conference Manual made its appearance this year.

From the Aviation Division, whose conference theme was "This Shrinking World," and the Heat Transfer Division's Symposium on Thermal Properties of Gases, Liquids and Solids, where missiles and rockets commanded a large share of attention, through the alphabet to Textile Engineering and Wood Industries Division, all of ASME's professional units can point to a year of rapid progress and challenges met.

While aviation men headed into space, those at the Gas Turbine Power Conference heard of VTOL aircraft that may make the earthling dream of "downtown to downtown" air travel a reality.

Metals engineering personnel discussed "astounding" developments in metallics, ceramics, lubricants, fuels and plastics and at the Design Engineering Conference, attendees were told of major advances in new organic plastics that can resist transient temperatures up to 15,000° F, challenging the previous champions, metals and ceramics.

Production engineers, while reviewing new processes and equipment, prepared themselves to meet the challenge of competition from abroad, of an increasing population and a proportionally decreasing labor force.

Textile engineers focussed their attention on improved equipment for even better results in dyeing and bleaching of fabrics and railroad men discussed new lightweight passenger cars.

The two general meetings continued their survey of new horizons. Attendees considered such topics as ways to halt air pollution, new sources of energy and fuel, new auto engines, weather control, economical sea water distillation, nuclear reactor design, H-iron production of steel, and fuel cells.

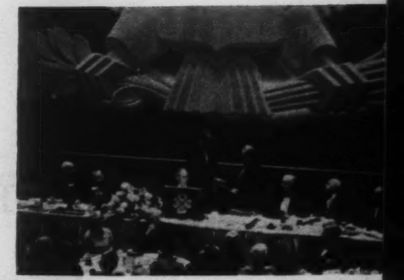
Together, the year's meetings and conferences pointed the way toward innumerable highways into the future.

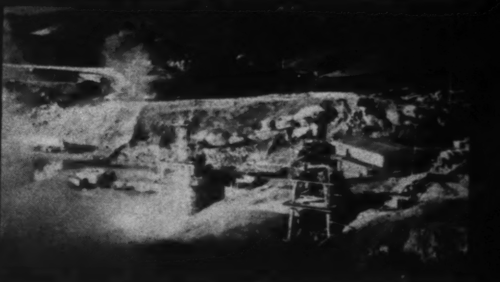
ASME Meetings and Conferences 1958–1959

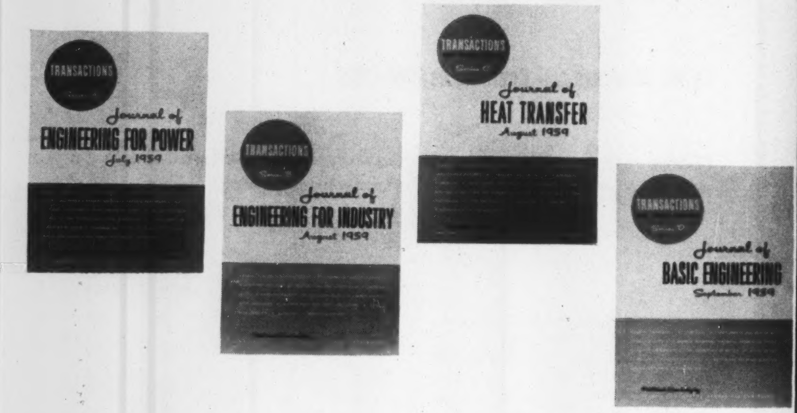
(Unless otherwise designated the conferences are sponsored solely by ASME or its Divisions. Listed in chronological order.)

	Sessions	ASME Papers	Copies Available	Attendance
ASME-AIME Solid Fuels Conference Old Point Comfort, Va.	3	6	3	220
ASME-ASLE Lubrication Conference Los Angeles, Calif.	6	10	10	220
Annual Meeting New York, N. Y.	128	392	298	5734
Symposium on Thermal Properties of Matter Lafayette, Ind.	9	42	*	150
Gas Turbine Power Conference & Exhibit Cincinnati, Ohio	7	20	20	492
Aviation Conference Los Angeles, Calif.	20	79	52	885
Textile Engineering Conference Clemson, S. C.	3	10	none	210
Lubrication Conference Philadelphia, Pa.	4	17	none	133
Instrument & Regulators Conference Cleveland, Ohio	5	16	12	139
American Power Conference † Chicago, Ill.	2	7	3	2891
Nuclear Congress † Cleveland, Ohio	22	109	104	3347
ASME-AIEE Railroad Conference Chicago, Ill.	4	6	2	200
Hydraulic Conference Ann Arbor, Michigan	20	6	20	140
Oil & Gas Power Conference & Exhibit Houston, Texas	7	12	10	562
ASME-SAM Management Conference New York, N. Y.	7	16	*	657
Metals Engineering Conference Albany, N. Y.	8	26	14	344
Maintenance & Plant Engineering Conference Chicago, Ill.	3	5	5	124
Production Engineering Conference Detroit, Michigan	10	21	12	234
Conference on Automatic Techniques † Chicago, Ill.	5	6	6	200
Design Engineering Conference and Exhibit Philadelphia, Pa.	8	14	14	1335
ASME-AMHS Materials Handling Conference Cleveland, Ohio	3	4	3	124
Semi-Annual Meeting St. Louis, Mo.	34	85	65	800
Applied Mechanics Conference Troy, N. Y.	4	30	30	190
ASME-AIChE Heat Transfer Conference Storrs, Conn.	12	28	28	617
ASME-FPRS-AIChE Wood Industries Conference Portland, Ore.	6	26	*	275
Applied Mechanics Western Conference Stanford, Calif.	9	39	23	200
ASME-AIEE-Engineering Management Conference Los Angeles, Calif.	4	10	9	450
Petroleum Mechanical Engineering Conference Houston, Texas	22	55	45	714
ASME-AIEE National Power Conference Kansas City, Mo.	6	18	18	450
	381	1115	806	22037

* Papers published in Proceedings of Conf.
† Participation by ASME







New Publication series

PUBLICATIONS • CODES • STANDARDS

A major new service to the engineering profession, in the form of five quarterly journals, was introduced by the Society during the year and met with immediate success. The five journals, a streamlined adaptation of *Transactions of the ASME,* published since 1880, are designed as a permanent repository for articles and papers of lasting interest to engineers.

Under the new procedure, engineers and institutions need not subscribe to the entire *Transactions* series, but may select any one, or any combination, of the five quarterlies, each of which covers a single fundamental field. In addition to economy for subscribers, the new system permits simplified indexing, speedier processing of editorial matter and wider distribution of fundamental information.

Circulation of the journals during the first year exceeded all expectations.

CODES AND STANDARDS

ASME's Codes and Standards Service, which provides government, industry and manufacturers with guideposts to safe, efficient construction and operation, had one of its most productive years. The committees, engaged in one of the Society's most vital and best-known services, turned out 32 codes and standards during the fiscal year.

A highlight of the year was complete revision and publication of the *ASME Boiler and Pressure Vessel Code,* nearly 1100 pages, which now includes all case interpretations and revisions made since the last complete republication in 1956.

The Boiler and Pressure Vessel Committee could also point proudly to the growing acceptance of the ASME Boiler and Pressure Vessel Code by government bodies in the U.S. and Canada. About 40 certificates of authorization and code symbol stamps were issued monthly during the year, an increase of 15% over last year. The stamps are used by manufacturers to indicate that their equipment conforms to the ASME code.

The committee also held a special meeting on the application of ultrasonic techniques to non-destructive examination of metallic materials.

Needed case interpretations covering aspects of construction in the nuclear power field were issued during the year.

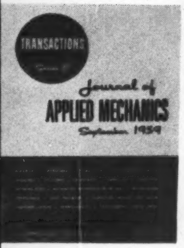
Three important Power Test Codes and supplements on Instruments & Apparatus made their appearance: PTC 20.1-1958, Speed-Governing Systems for Steam Turbine Generator Units; PTC 19.11-1959, Methods for the Determination of the Quality and Purity of Steam; and PTC 19.5.4-1959, Ch. 4, Flow Measurement by Means of Thin Plate Orifices, Flow Nozzles and Venturi Tubes.

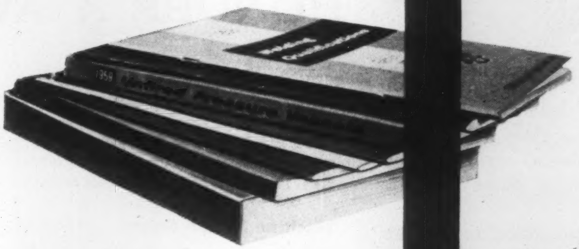
In sessions viewed with interest by railroads, truckers, airlines and all freight movers, an ASME committee on the size of shipping containers set to work on standardization. Agreement on size of these packing boxes is expected to save freight handlers time and money.

Another ASME project gained world-wide prominence when parts of the "Glossary of Terms in Nuclear Science and Technology" were submitted to the International Organization for Standardization. This glossary, originally published as an ASME Standard, has since been accepted as an American Standard.

PUBLICATIONS ROUNDUP

A major part of ASME's service is providing members with printed material enabling them to keep up with rapid changes in technology. This year, in addition to *Mechanical Engineering,* which goes to every member, the Society prepared more than





475,000 individual copies of 806 technical papers and maintained a stock of some 300 books, codes, standards and other publications. Orders came in for over 75,000 copies of special publications and for more than 150,000 copies of technical papers.

Many Society magazines continued to grow in size and circulation as demand for specialized information grew. The number of pages in the long-established *Applied Mechanics Reviews* jumped by 25%. To provide its readers with news of the most interesting developments from all over the globe, AMR scanned literature from 37 countries and also presented full articles on highlights and trends in particular fields. More than 6000 reviews appeared in the 12 issues.

Translation of PMM, the Russian *Journal of Applied Mathematics and Mechanics,* proved successful. The Society will undertake translation of two Russian books in 1960. As with PMM, which is now in its second year, the venture will be financed by the National Science Foundation.

ASME has also concluded an agreement with AIChE to reduce subscription rates for journals of mutual interest to their respective members. For a two year trial period ASME members can subscribe to the *AIChE Monograph and Symposium Series* in the field of heat transfer at AIChE member rates and chemical engineers may subscribe to the *Journal of Heat Transfer* at ASME member rates.

MONOGRAPHS

For many years, ASME has been a member of the Engineering Societies Monographs Committee, which attempts to provide the profession with monographs of high technical quality, to develop manuscripts to fill gaps in existing literature, and to collect into one volume timely, but scattered, information on a given subject. The committee evaluates all manuscripts submitted to it and those deemed to fill a need are published.

New Publications in 1959

ASME BOILER AND PRESSURE VESSEL CODE

Power Boilers
Material Specifications
Low-Pressure Heating Boilers
Miniature Boilers
Suggested Rules for Care of Power Boilers
Unfired Pressure Vessels
Welding Qualifications
Case Interpretations

AMERICAN STANDARDS

Industrial Power Trucks
Reamers
Taps—Cut and Ground Threads
Unified Miniature Screw Threads
Illustrations for Publication and Projection
American Drafting Standards Manual—
    Metal Stamping
    Fluid Power Diagrams
    Forgings
Pallet Sizes
American Standard Lock Washers
C I Pipe Flanges and Flanged Fittings—
    Class 125 B16.1
    Class 250 B16.2
Petroleum Refinery Piping
Oil Transportation
Gas Transmission and Distribution Piping Systems
Letter Symbols for Acoustics
Graphical Symbols for Welding
Cast-Brass Solder-Joint Drainage Fittings
Driving and Spindle Ends for Portable Air and Electrical Tools
Inserted Blade Milling Cutter Bodies
Class 5 Interference-Fit Threads

POWER TEST CODE

Speed-Governing Systems for Steam Turbine-Generator Units

INSTRUMENTS AND APPARATUS

Part 5—Flow Measurement
Part 11—Quality and Purity of Steam

MISCELLANEOUS SUBJECTS

Fluid Meters—Their Theory and Application
Corrosion and Deposits in Boilers and Gas Turbines
Diaphragm Characteristics, Design and Terminology
Symposium on Numerical Control of Machine Tools for Aircraft and Missile Production

AIR POLLUTION

Instruments for the Study of Atmospheric Pollution

MECHANICS—HEAT TRANSFER

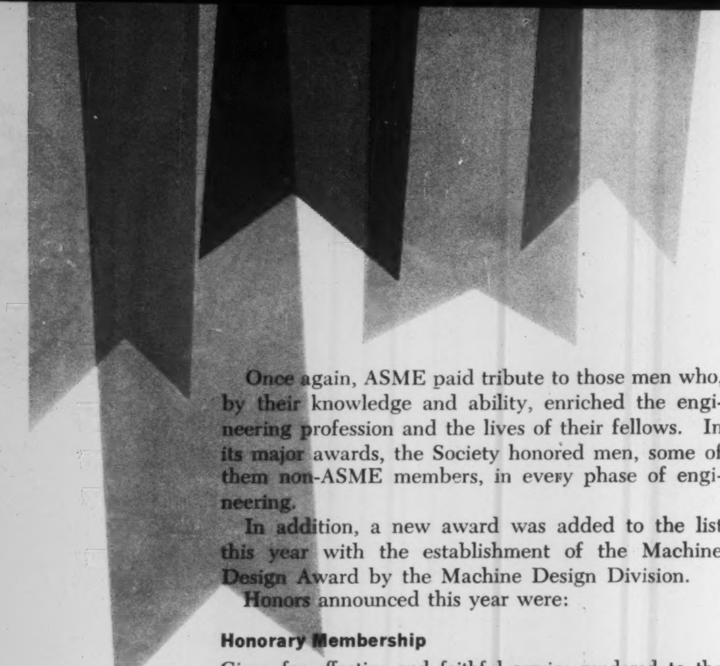
Thermodynamic and Transport Properties of Gases, Liquid and Solids
Mechanical Impedance Methods for Mechanical Vibrations
Proceedings, 3rd U.S. National Congress of Applied Mechanics

NUCLEAR ENGINEERING

Power Reactors. Volume 1 of Nuclear Reactor Plant Data
Research and Test Reactors. Volume 2 of Nuclear Reactor Plant Data

BIOGRAPHY

Modern Jupiter—The Biography of Charles Proteus Steinmetz



HONORS & AWARDS

Once again, ASME paid tribute to those men who, by their knowledge and ability, enriched the engineering profession and the lives of their fellows. In its major awards, the Society honored men, some of them non-ASME members, in every phase of engineering.

In addition, a new award was added to the list this year with the establishment of the Machine Design Award by the Machine Design Division.

Honors announced this year were:

Honorary Membership

Given for effective and faithful service rendered to the Society, to the engineering profession or to the public.

Thomas Bradford Drew, Member, ASME
Professor of Chemical Engineering
Columbia University
New York, N. Y.

"For distinguished services to government, education, industry and technical societies in developing the engineering sciences in fluid mechanics, heat transfer and diffusional processes."

Ben Moreell
Member, Board of Directors
Jones & Laughlin Steel Corporation
Pittsburgh, Pa.

"For his driving force based on faith. His unrelenting effort to realize that faith which has made him such a masterful influence for constructive progress in his community, his state, our nation and the world at large. The forces which he has sought to bend to goodwill and reason do not easily yield to imaginative and dedicated statesmanship. But the dreamer in Admiral Moreell has never relented—the dreamer of a dream which gradually becomes reality when brave men have the wisdom and the will to stand firm for the causes they hold sacred."

Holley Medal

Bestowed only for some great and unique act of engineering genius that has accomplished an outstanding and timely public benefit.

Colonel Maurice J. Fletcher
Director, Army Prosthetics Research Laboratory
Walter Reed Army Medical Center
Washington, D. C.

"For his valuable contributions to the science of prosthetics, specifically for his inventive genius and engineering skill in designing artificial hand devices to give amputees an opportunity to live a more nearly normal and useful life."

Timoshenko Medal

Given in recognition of distinguished contributions to applied mechanics.

Sir Richard Vynne Southwell
Cambridge, England

"For teaching and research in the applications of mathematical and numerical techniques to the solution of practical problems in engineering science."

Machine Design Award

Awarded for eminent achievement or distinguished service in machine design.

Charles Edwin Crede, Member, ASME
Associate Professor of Mechanical Engineering
California Institute of Technology
Pasadena, California

"Inspired leader in the field of shock and vibration, who through eminent achievement by creative contributions in the research, development, and application of shock mounts has advanced the field of machine design and furthered the interest and study in shock and vibration control by virtue of technical literature and a published textbook devoted thereto."

Worcester Reed Warner Medal

Awarded for an outstanding contribution to the permanent literature of engineering.

Samuel Glasstone
Consultant, U. S. Atomic Energy Commission
Los Alamos Scientific Laboratory
Los Alamos, New Mexico

"For his outstanding contribution to permanent engineering literature in his writing on atomic energy as exemplified by his book, 'Sourcebook on Atomic Energy.'"

Melville Medal

Awarded to an ASME member for an original paper or thesis of exceptional merit presented before the Society for discussion and publication during the preceding year.

Stephen Jay Kline, Member, ASME
Associate Professor, Mechanical Engineering
Stanford University
Stanford, California

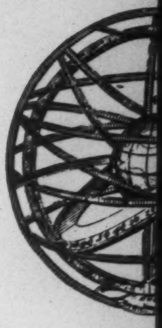
For his paper, "On the Nature of Stall."

Prime Movers Committee Award

Conferred in recognition of outstanding individual or multiple author contributions to the literature of thermal electric station practice or equipment.

J. Kenneth Salisbury, Fellow, ASME
Consulting Engineer
Atherton, California

For his paper, "A New Performance Criterion for Steam-Turbine Regenerative Cycles."



Junior Award

Presented to an Associate Member of the Society for an original paper, which is a distinct contribution to the literature of mechanical engineering.

Victor Salemann, Associate Member, ASME
Group Supervisor, Research Development Section
Worthington Corporation
Harrison, N. J.

For his paper, "Cavitation and NPSH Requirements of Various Liquids."

Richards Memorial Award

Given to the mechanical engineer who has demonstrated outstanding achievement within 20–25 years of graduation.

Mylon Eugene Merchant, Member, ASME
Director of Physical Research
The Cincinnati Milling Machine Co.
Cincinnati, Ohio

Pi Tau Sigma Gold Medal Award

Awarded to a mechanical engineer for outstanding achievement within 10 years after graduation.

Donald Frank Hays
Research Laboratories
General Motors Corporation
Warren, Michigan

Arthur L. Williston Award

Given for the best thesis by an undergraduate student or a junior engineer on a prescribed topic designed to encourage civic responsibility and interest in social or public activites.

Rowe Angelo Ghirardini, Associate Member, ASME
Norwich University, 1959

For his paper, "A Joint Responsibility."

Charles T. Main Award

Awarded for the best paper by a Student Member on the influence of engineering on public life.

James Lowell Benson, Student Member, ASME
University of Vermont, 1960

For his paper, "Professional Attitudes of the Engineer."

Undergraduate Student Award

Presented for the best paper or thesis by a Student Member.

Frederick C. Borjes, Associate Member, ASME
Newark College of Engineering, 1959

For his paper, "Here Comes the A-Plane."

Old Guard Prize

Awarded to the winner of the National Contest of Student Members who have won first prize at each of the twelve Regional Student Conferences.

James S. Kishi, Student Member, ASME
University of Texas, 1959

For his paper and presentation, "Boundary Layer Control by Suction Through Distributed Perforations."

JOINTLY WITH OTHER SOCIETIES ASME ALSO HONORED THESE MEN:

Wallace Clark Award

For distinguished contribution to scientific management in the international field.

Count Pierre Baruzy, Paris, France

John Fritz Medal

For notable scientific or industrial achievement.
Gwilym A. Price, Chairman of the Board
Westinghouse Electric Corp.
Pittsburgh, Pa.

Daniel Guggenheim Medal

For notable achievement in advancement of aeronautics.
Sir George Edwards, Managing Director
Vickers Aircraft, Ltd.
Weybridge Surrey, England

Herbert Hoover Medal

For distinguished public service.
Henry T. Heald, President
Ford Foundation
New York, N. Y.

Marston Medal

For achievement in engineering.

Murray Joslin, Chicago, Ill.

Alfred Noble Prize

For the most meritorious technical paper published by participating societies.

Paul Shewmon, Pittsburgh, Pa.

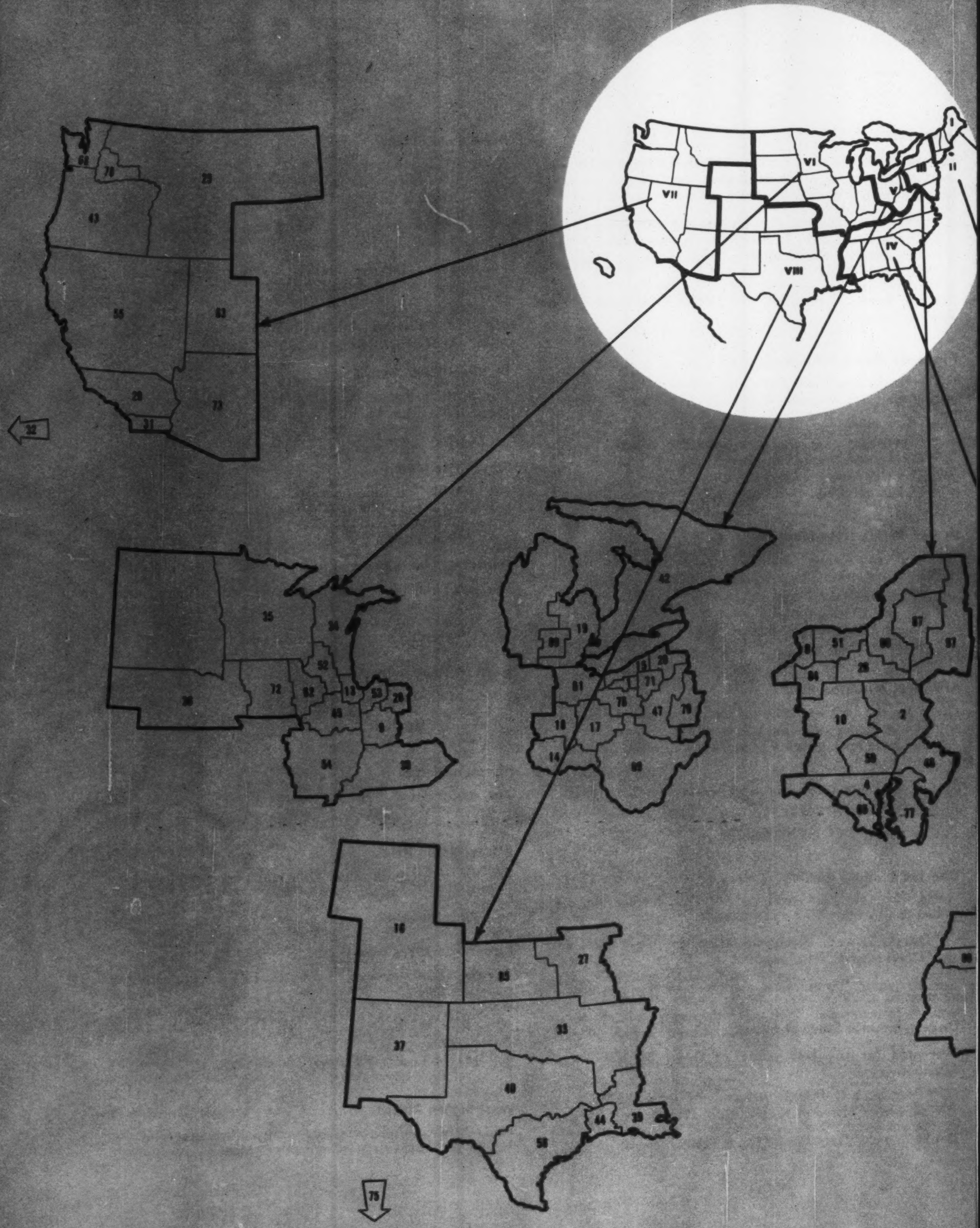
Elmer A. Sperry Award

For the encouragement of progress in the engineering of transportation.

de Havilland Aircraft Company, Ltd.
Sir Geoffrey de Havilland, President
C. C. Walker
Major Frank Halford (in memoriam)
and their co-workers.

Washington Award

For advancing human progress through engineering.
James R. Killian, Jr., Cambridge, Mass.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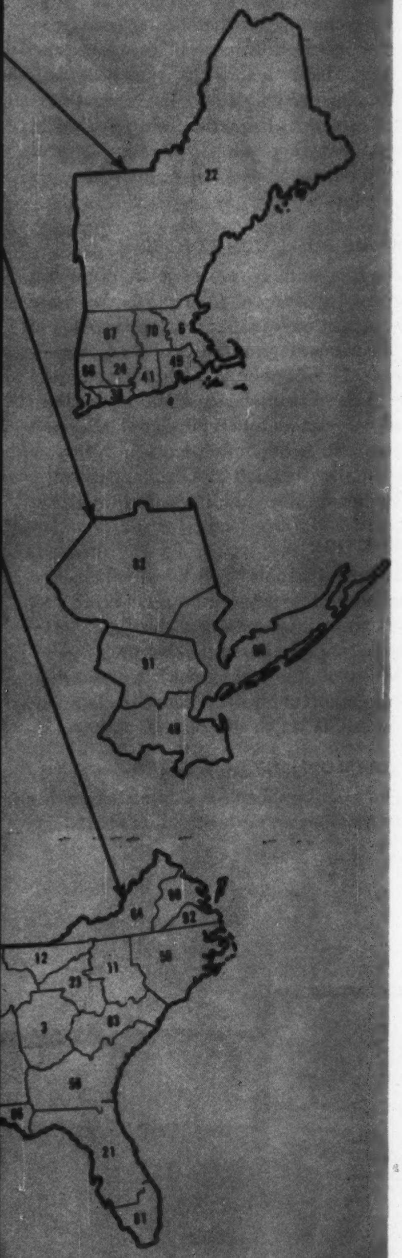
THE ASME MEMBERSHIP



Section and Code Numbers	Membership
REGION	
Boston (6)	1568
Fairfield County (7)	494
Hartford (24)	549
New Haven (38)	211
New London (41)	142
Northern New England (22)	262
Providence (49)	328
Waterbury (66)	150
Western Mass. (67)	242
Worcester (70)	241
Total	4187
REGION II	
Metropolitan (80)	3607
Mid-Hudson (82)	178
Mid-Jersey (48)	805
Northern New Jersey (91)	1588
Total	6178
REGION III	
Anthracite-Lehigh Valley (2)	449
Baltimore (4)	679
Buffalo (8)	380
Central Pennsylvania (10)	141
Delaware (77)	494
Hudson Mohawk (57)	625
Mohawk Valley (87)	102
Olean (84)	118
Philadelphia (46)	2167
Rochester (51)	327
Southern Tier (26)	348
Susquehanna (59)	209
Syracuse (60)	262
Washington, D. C. (65)	790
Total	7091
REGION IV	
Atlanta (3)	318
Birmingham (5)	389
Central Savannah River Area (83)	144
Central Virginia (90)	185
Chattanooga (74)	292
East Tennessee (12)	295
Eastern North Carolina (50)	168
Eastern Virginia (92)	176
Florida (21)	374
Greenville (23)	122
Miami (81)	159
North Alabama-Mississippi (88)	187
Northwest Florida (86)	157
Piedmont-Carolina (11)	270
Savannah (56)	101
Virginia (64)	221
Total	3558
REGION V	
Akron (1)	396
Canton-Alliance-Massillon (76)	219
Central Michigan (89)	113
Cincinnati (14)	809
Cleveland (15)	804
Columbus (17)	395
Dayton (18)	329
Detroit (19)	1140
Erie (20)	213
Ontario (42)	541
Pittsburgh (47)	1208
Toledo (61)	206
Westmoreland (79)	205
West Virginia (69)	311
Youngstown (71)	140
Total	7029
REGION VI	
Central Illinois (45)	284
Central Indiana (9)	439
Central Iowa (72)	172
Chicago (13)	2126
Fort Wayne (28)	81
Iowa-Illinois (62)	221
Louisville (30)	305
Milwaukee (34)	773
Minnesota (35)	458
Nebraska (36)	169
Rock River Valley (52)	211
St. Joseph Valley (53)	180
St. Louis (54)	558
Total	5977
REGION VII	
Arizona (73)	241
Columbia Basin (78)	128
Hawaii (32)	99
Inland Empire (25)	155
Los Angeles (29)	2745
Oregon (43)	178
San Diego (31)	274
San Francisco (55)	1686
Utah (63)	147
Western Washington (68)	601
Total	6254
REGION VIII	
Central Kansas (85)	122
Kansas City (27)	465
Mexico (75)	118
Mid-Continent (33)	548
New Mexico (37)	338
New Orleans (39)	416
North Texas (40)	682
Rocky Mountain (16)	367
Sabine (44)	126
South Texas (58)	803
Total	3985
Sub-total	44,259
Not in Sections	2545
Student Members	11,617
Grand-total	58,421

ASME ENGINEERING SERVICES...

Like all service organizations, ASME has many boards and committees devoted to gathering, formulating and using specialized material for both ASME members and the interested public. The work of these boards and their volunteer members makes ASME's general technical service more effective and complete through concentration on specific areas and avoidance of duplication.

Among the most important of these groups are the Society's Professional Divisions, whose activities are discussed in more detail in the section of this report dealing with meetings and conferences.

NEW HUMAN FACTORS GROUP

Fiscal 1959 saw the birth of a new professional group to deal with an increasingly important problem—the relation of man to machine.

The Human Factors Group, as it will be known, has for its objectives to "maximize man-machine system performance and to minimize problems arising from improper man-machine interactions." A further goal is to promote better communications between practicing engineers and scientists in such fields as physiology and psychology so that the scientist can undertake needed research on current problems and the engineer may have access to the necessary knowledge of human capacities and limitations.

The group has, since its formation, participated in the 1958 Annual Meeting, the 1959 Semi-Annual Meeting and co-sponsored the 1959 Annual Meeting of the Human Factors Society.

TUBULAR POWER FUEL ELEMENT
FUEL ELEMENT TO BE EVALUATED IN A TEST
AMERICAN BRASS COMPANY - WATERBURY, CONN
CONCORD, MASS.

Exhibits at ASME-sponsored meetings attract visitors from all parts of the world.

COMMITTEE ON AIR POLLUTION CONTROLS

To aid businesses and government in obtaining suitable equipment for study of their particular smog problems, the committee sponsored its third edition of Report on Instruments for the Study of Atmospheric Pressure. The booklet, which is a comprehensive listing of devices for air pollution investigation and control, was completely revised and enlarged.

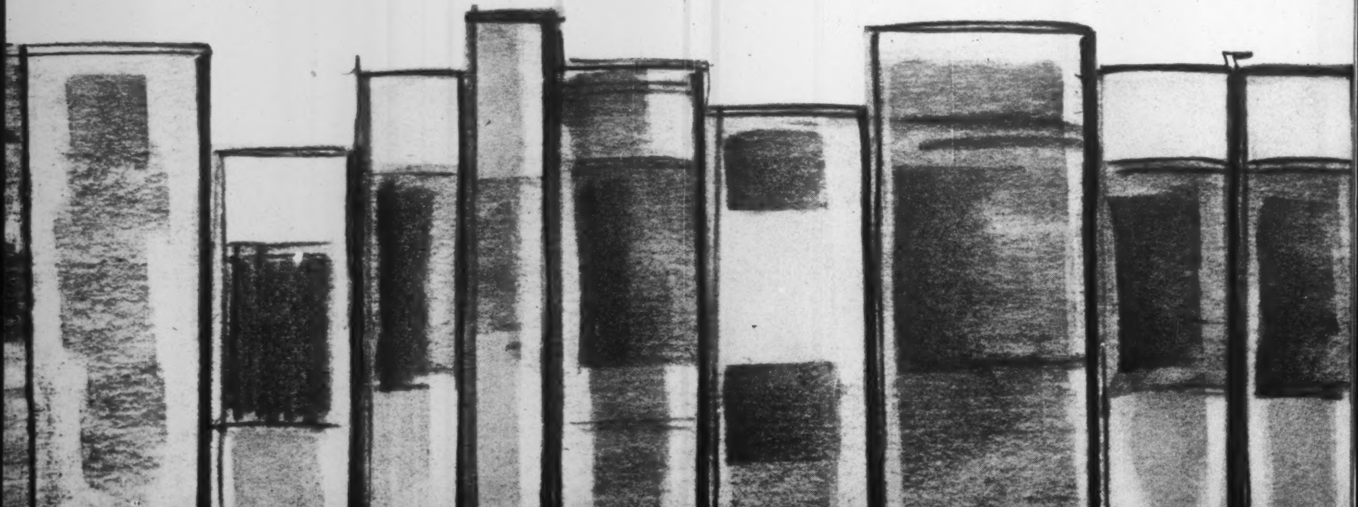
The committee also is beginning work in a review of the Model Smoke Regulation Ordinance and a revision of its Report on Research in Air Pollution.

BOARD ON EDUCATION

In answer to a "grass-roots" call by members, the National Committee of Mechanical Engineering Department Heads went into operation this year. The committee hopes to promote understanding by department chairmen of the problems of accreditation by Engineers' Council for Professional Development and the place of ASME in this important activity.

MEMBERSHIP DEVELOPMENT COMMITTEE

"Member's File," a publication aimed at giving the new Society member an understanding of ASME's



somewhat complex activities and the diversity in active participation open to him, was produced by the committee, in cooperation with ASME headquarters staff.

RESEARCH

The Society's Research Executive Committee reported continued progress during the year in its programs of coordinating and sponsoring "nonproprietary" research projects. Among the areas under investigation during the year were behavior of pressure vessel materials, lubrication, properties of steam, and corrosion and deposits from combustion gases.

An investigation of Bourdon tubes, carried out by the Research Committee on Mechanical Pressure Elements, was completed.

Reports from researchers investigating high pressure and temperature steam properties indicate a stumbling block in their efforts to measure steam properties at temperatures as high as 1500 F and at pressures of 15,000 pounds per square inch. They have found that the dissociation of steam into free hydrogen and oxygen results in a most undesirable situation; the hydrogen goes into the solution with steel surfaces in contact with it and the oxygen corrodes these same surfaces. The resulting rust flakes hamper accurate and precise measurements. One suggestion, a most expensive solution, is to sheath the surface in contact with the steam with pure gold, which should alleviate the problem.

Proposals for the initiation of a research project on prevention of fracture in metals and another project to improve the design of fluid meters are now under consideration by the respective research committees.

METALS ENGINEERING HANDBOOK MANAGING COMMITTEE

This committee is charged with reviewing and revising the metals engineering handbooks to keep them current and of maximum use. It replaces the Metals Engineering Handbook Board, under whose auspices the series was produced.

SOLAR ENERGY APPLICATION COMMITTEE

"During the past year," reports the committee, "the importance of solar energy as a power source for satellites and space platforms has been receiving serious attention and, for the first time, mechanical engineers are beginning to come into the picture in substantial numbers. Also, for the first time, research and development funds of substantial size are beginning to be made available and it is very probable that the advances made as a result of the space program will find wide use on the surface of the earth."

Breakthroughs may come in the utilization of solar energy in sea water distillation, house heating and solar cooking devices. As in the past, "it will be a major function of the Solar Energy Applications Committee to report to the Society on these developments as rapidly as the information becomes available."

ASME PUBLIC RELATIONS

Objectives of ASME's public relations program, briefly stated, are to encourage a greater public understanding and appreciation of ASME, its members, and their work, and to aid in the completion of the various tasks of the Society. This program continued during the year, under the guidance of the Public Relations Committee.

TO MEMBERS AND THE PROFESSION...

Television interviews are one way to explain engineering achievements.

Major activities carried out during the year included preparation of news releases on important Society activities, including meetings, conferences, honors, elections, appointments, publications and special events.

The public relations staff also aided in encouraging on the spot news coverage by newspapers, magazines, television and radio of major meetings and conferences of the Society.

ASME cooperated during the year in preparation of literature in support of the United Engineering Center, Engineers Week, and activities of joint bodies such as Engineers Joint Council.

More than one million people, many of them students considering a career in engineering, saw "To Enrich Mankind," ASME's color movie, during the year, bringing the total estimated audience since the film was produced in 1956 to over fifteen million.

Publicity and public relations committees of Professional Divisions and Sections in the field carried out a number of projects.

Counselling and guidance to younger students by Section members was continued this year. Many Sections sponsored "science fairs," or participated in career day activities, to inspire high school students who have the interest and ability to become engineers or scientists.

WOMAN'S AUXILIARY

Now in its thirty-seventh year, the Woman's Auxiliary to the ASME continued its work of awarding scholarships, administering student loan funds and acting as partner to the Society in operation of programs and social events. Membership in the Auxiliary has reached a total of 1,950.

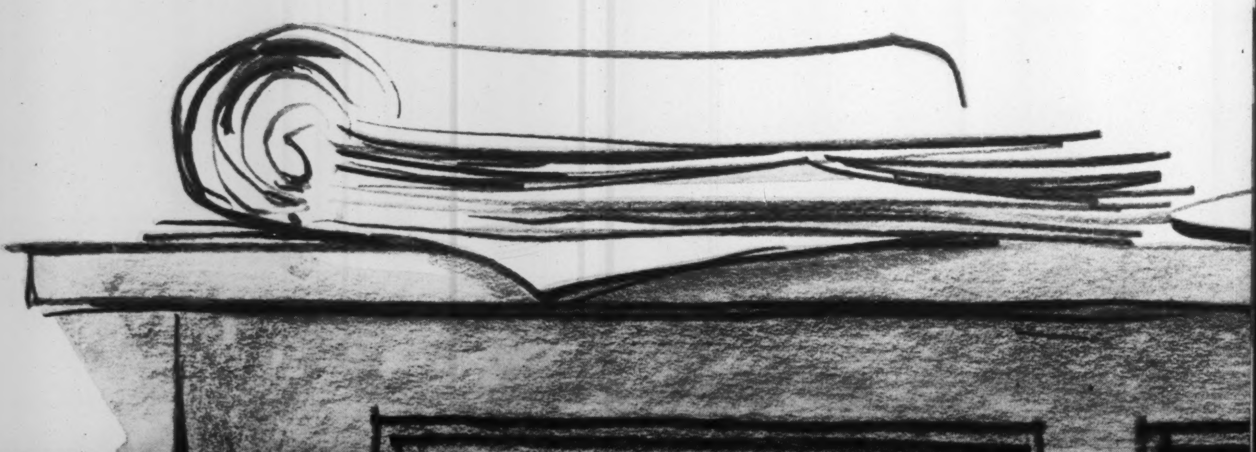
During 1959, the Auxiliary assumed several new obligations, including a pledge of $1000 to the United Engineering Center Building Fund. The recently established Marjorie Roy Rothermel Scholarship was awarded for the first time this year. The $750 grant went to Mr. Steve Wutzke for graduate study at the University of Illinois.

Other scholarships totalling $3500 were also awarded during the year to students of engineering.

In summarizing its activities for the year, the Auxiliary noted "unprecedented requests for loans" from engineering students and expressed appreciation to several of its sections which made additional contributions to the Student Loan Fund. Outstanding loans total $18,000.

LECTURERS

Serving without financial remuneration, to bring the most up-to-date technical information to Society members, ASME lecturers play an important part in many Section programs. The lecturers, all experts



in their fields, highlight significant new facts and trends to provide their listeners with an outstanding way of keeping abreast of current knowledge.

This year's lecturers and their topics are:

Dr. Orson L. Anderson, Bell Telephone Laboratories, Inc., "The Adhesion of Solids."

Frank R. Barnett, Director of Research, The Richardson Foundation, Inc., "Education, Strategy and Fourth Dimension Warfare."

Dr. Hans Conrad, Metallurgy Department of Westinghouse Electric Corporation's Research Laboratories, "Design of High Temperature Alloys."

Dr. R. N. Hall, Research Laboratories of the General Electric Company, "Properties and Uses of Imperfections in Non-Metallic Crystals," and "The Role of Imperfections in Modern Semi-Conductor Technology."

Charles Katz of the Remington Rand UNIVAC Division of Sperry Rand, "Computers that Understand English."

Dr. P. Frank Martinuzzi, Professor of Mechanical Engineering, Stevens Institute of Technology, "Automotive Gas Turbines," "Nuclear Energy," "The Future of Atomic Power Plants" and "Latest Developments in the Gas Turbine Field."

Dr. J. W. Mauchly (inventor of UNIVAC), Director of UNIVAC applications for the Remington Rand UNIVAC Division of Sperry Rand Corporation, "Use of Computers by Engineers."

Professor Paul M. Stafford, Head of the Department of General Engineering at the South Dakota School of Mines and Technology, "Creative Imagination," and "Engineering Creativeness."

OLD GUARD

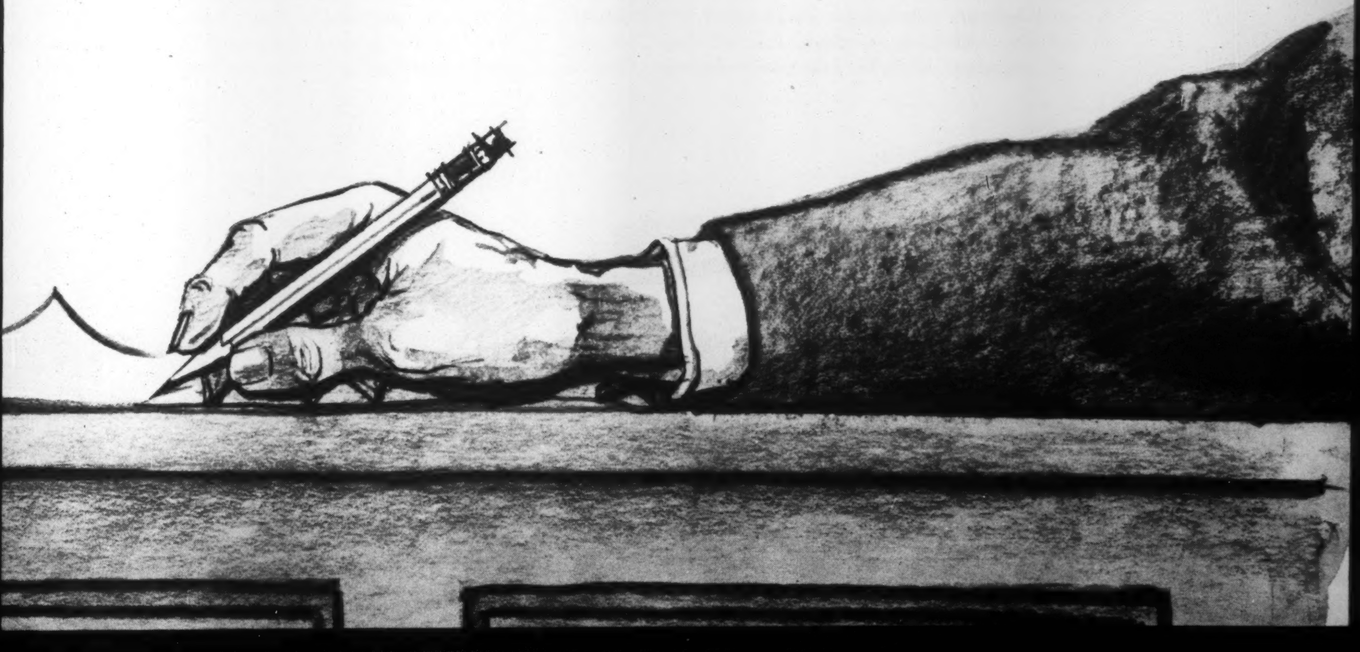
Without fanfare, but in an atmosphere of dedication, the Old Guard Committee continued its financial and professional aid to younger members of ASME. The primary purpose of the Committee is to help "the young man to bridge the gulf between student life and the full participation of membership in our Society and profession."

With contributions collected from those members of the Society who have 35 years or more of membership behind them, and who no longer must pay dues, but voluntarily make payments to the Old Guard Fund, the Committee sponsors, among other things, the Old Guard Prize awarded annually to a Student Member. The Committee pays the transportation expenses for each of 12 winners of Regional contests to the Semi-Annual Meeting, where they are judged and the national winner selected.

The winner receives a prize of $150 and an expense-paid opportunity to present his paper at the Annual Meeting. This year's winner was James Kishi of the University of Texas.

The Old Guard also pays for the free copies of the *Unwritten Laws of Engineering* and *Professional Guide for Junior Engineers* that go to each senior Student Member of ASME. The National Junior Committee often seeks the advice and counsel of the Old Guard.

During the past year, the Old Guard published a small leaflet, outlining its history and objectives. A copy was sent to each dues exempt ASME member, to encourage even greater participation in the work of aiding in the guidance and recognition of young engineers.



IN A WORLD OF CHANGE

While emphasizing its activities in behalf of mechanical engineers, ASME has always felt that vigorous cooperation with other engineering groups could produce a greater benefit to its own members and unity with the engineering profession.

ENGINEERS JOINT COUNCIL

Through its membership in Engineers Joint Council, an organization which represents 21 engineering societies, ASME aided in the following projects:

—Issuance of salary reports on professional income of engineers and salaries of engineering teachers and of a survey on enrollment trends in engineering curricula.

—The Nuclear Congress, for which ASME provided the management and public relations for the second time in three years.

—Collection of recommendations for a list of nominees to be considered for the National Science Foundation Board of Directors, and for the staff of the National Science Foundation.

—Testimony, as requested at various committee hearings on bills affecting engineering sciences.

—Preparation of advertisements defining the engineer in relation to the scientist, especially for the benefit of newspaper editors and others in the communications industry, which have been widely published.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

Engineers' Council for Professional Development, of which ASME is a member, concluded its 27th year of operation in 1959. At year's end the Council reported a substantial growth in its activities, including inspection and accreditation of engineering curricula and distribution of literature to young engineers designed to acquaint them with the professional aspects of engineering and encourage their development.

Scale models of cargo containers help committees arrive at standard dimensions.

Eight national engineering societies, ASME among them, work through ECPD for the professional advancement of engineers. An indication of the scope of this work lies in the fact that the ECPD Education and Accreditation Committee reported this year the evaluation of 428 curricula at 84 institutions.

Further discussions were held during the year with a view toward the possibility of a merger of ECPD and EJC.

AMERICAN AUTOMATIC CONTROL COUNCIL

The council's main job this year has been securing papers for the first International Congress of the International Federation on Automatic Control. It has gathered over 100 papers so far for the meeting which will be held in June, 1960, in Moscow, Russia.

LIBRARY

ASME, of course, also helps to support the Engineering Societies Library, use of which increased again this year. The Library now receives some 1562 periodicals, of which 850, printed in 21 different languages, come from abroad. Its staff also continued to provide literature searches, translations, bibliographies, photoprints and microfilm copies of material in the Library. Many of these requests came from foreign countries.

IAESTE

Formed to encourage cooperation and a greater exchange of knowledge among countries, the International Association for the Exchange of Students for Technical Experience, to which ASME contributes support, continued its work at a record pace. This group placed 98 American students (of the 190 who applied) with firms abroad. Of this number, thirty mechanical engineering students requested jobs abroad and 27 were placed, the record for any engineering specialty.

Sixty-six students from abroad received jobs in this country and, again, the greatest number placed were in the mechanical engineering field.

CANADA

Continued cooperation with the Engineering Institute of Canada was also evidenced. Among highlights was the Third Biennial Conference on Engineering Education co-sponsored by ASME and EIC at the University of Michigan in October of 1958. One hundred and seventeen delegates attended.

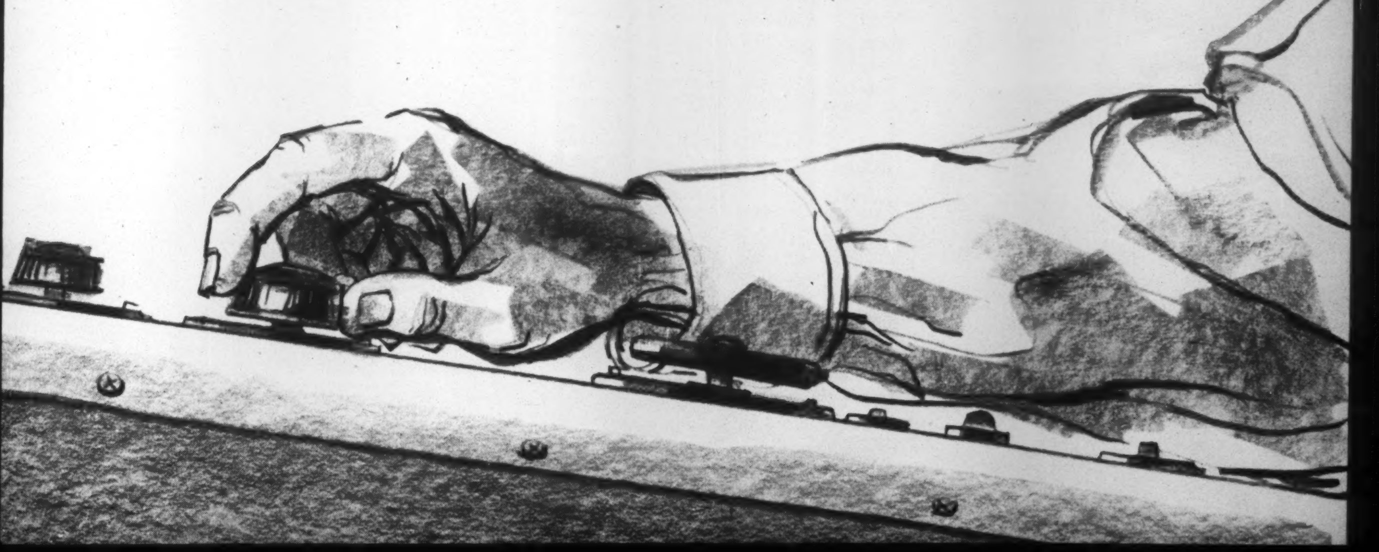
In June, 1959, the Calgary Branch of EIC assumed the role of host at a meeting of the ASME Boiler and Pressure Vessel Committee.

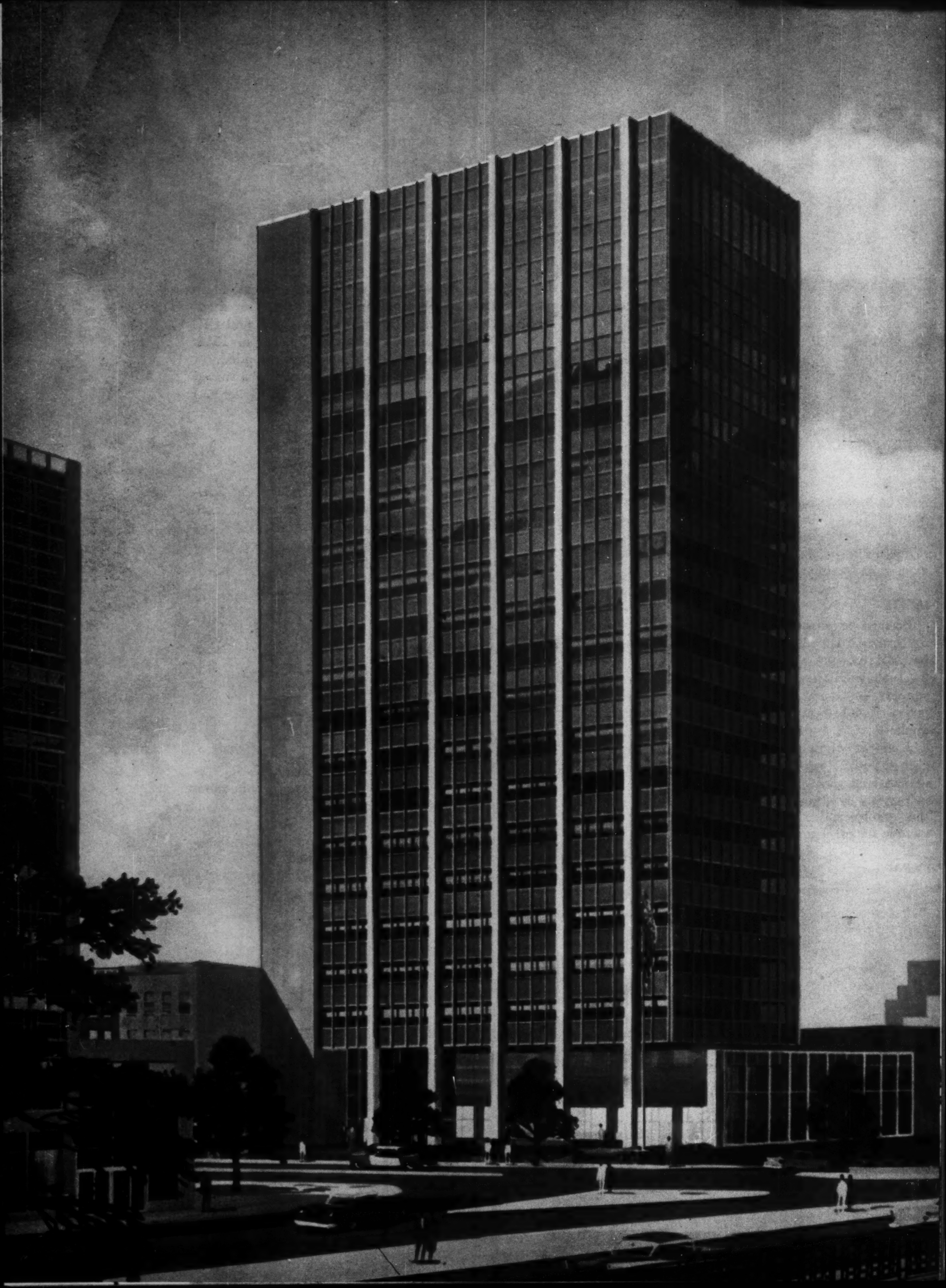
OTHER GROUPS

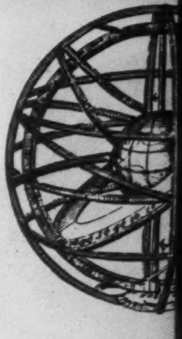
ASME also helps support the Engineering Societies Personnel Service, a job placement organization. From September 1, 1958, to August 31, 1959, the service received 3155 job openings and registered 3878 engineers. About 20% of those placed in positions were mechanical engineers.

Many other groups received ASME support or cooperation in their work, and, in turn helped to carry out objectives paralleling those of ASME.

These include, besides those mentioned elsewhere in this report: American Association for the Advancement of Science; American Institute of Architects (Joint Committee of the Design Profession); American Sanitary Engineering Inter-Society Board, Inc.; American Standards Association; Building Officials Conference of America, Inc.; U.S. Bureau of Standards; Council for International Progress in Management (USA, Inc.); The Engineering Foundation; National Bureau of Engineering Registration; National Research Council; National Safety Council; International Institute of Refrigeration; U.S. National Committee on Theoretical and Applied Mechanics and the U.S. National Committee of the International Electrochemical Commission.







Formal ground breaking for the United Engineering Center took place on October 1, 1959, to signal the start of a project more than eight years in the planning stages. Primary participants in the ceremony were former President of the United States Herbert C. Hoover, representing the generation of engineers who have already made their contributions to society, and an engineering freshman from Hawaii, the nation's newest State, symbolizing the future promise of engineering.

The $12,000,000 structure, eighteen stories in height, will stand opposite the United Nations Enclave in New York City. It will house the headquarters staffs of nineteen engineering groups.

A HOME FOR THE PROFESSION

As outlined in the President's Message, elsewhere in the report, fund-raising for the new Center has made progress but is not yet complete. At the end of the fiscal year, industrial contributions were approaching the $5,000,000 mark while gifts from members of the participating societies were nearing $3,000,000. ASME, at year's end, had achieved some 71% of its accepted quota.

Substantial additional assets will be available from United Engineering Trustees, which owns the existing Engineering Societies Building and will own the new United Engineering Center.

Latest figures from the architectural and engineering firms indicate that the Center will provide 263,067 square feet of gross floor area and approximately 179,885 square feet of net area, approximately double the present Engineering Societies Building.

ASME will occupy three floors with a total usable square footage of 20,800.

Elsewhere in the building will be a display area, intended to help explain the achievements of engineering, and the Engineering Societies Library. A number of meeting rooms, with movable partitions to permit consolidation into larger rooms, will afford space for committee meetings. Major meetings and conferences of the Society will be held elsewhere at locations around the country.

ASME FINANCES

ASME financial operation this year showed a favorable balance of income and expenditures, despite an anticipated deficit of nearly $26,000, budgeted early in the year. Gross income totalled $2,349,163.39, while expenditures came to $2,348,733.14, leaving an excess of income over expenditures of $430.25. This amount, plus initiation and transfer fees totalling $25,876.50 was set aside for reserve.

A further drop in the sale of advertising space in *Mechanical Engineering*, continuing last year's trend, was largely offset by a rise in income from sale of publications. In great part, this rise was traceable to the newly revised *ASME Boiler and Pressure Vessel Code* and the new series of quarterly publications which have superseded the older form of *Transactions*.

Nearly two thirds of ASME expenditures went into the production of publications. Allocations to Sections, Student Sections and Divisions accounted for almost 17 per cent of expenses, while the general expense of research administration, Council meetings, admissions, joint activities, public relations, awards, office administration reserve fund and miscellaneous came to 18 per cent.

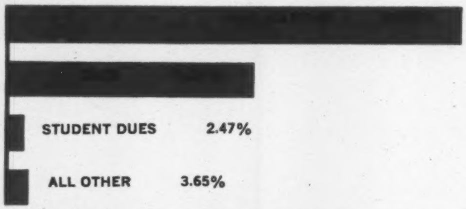
As in the past, the financial operations of the Society were guided by the Finance Committee with the aid of investment counsel. The detailed report of the Finance Committee, from which the information in this section is excerpted, is available to Society members on request. The certified report of the auditors, Price Waterhouse & Co., is on file in the Society's office and is available for inspection by ASME members.

INCOME AND EXPENSE 1958-1959

THIS IS WHERE THE MONEY CAME FROM

Publications	$1,425,191.41
Membership Dues	780,054.75
Student Dues	58,085.00
Research Reports	20,055.18
Meetings (non-member registration fees)	6,756.50
Miscellaneous (including interest)	59,020.55
Total	$2,349,163.39

INCOME



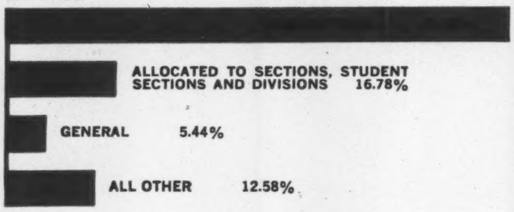
THIS IS WHERE THE MONEY WENT

Publications	$1,531,446.07
Sections	190,294.37
Student Sections	109,740.34
Divisions	94,189.66
Meetings	70,580.45
General (Council, Retirement Fund, Office Service)	127,704.49
Admissions and Membership Development	44,278.34
Joint Activities*	67,429.09
Research Administration**	42,764.50
Awards	11,508.42
Public Relations	38,534.98
Miscellaneous	20,262.43
Set aside for reserve	430.25
Total	$2,349,163.39

*Includes $33,000.00 for direct and indirect support of the Engineering Societies Library.

**In addition, over $100,000.00 from custodian funds were expended on research.

EXPENSE



BALANCE SHEET

On September 30, 1959, the Society owed:

(1) Federal and state income taxes withheld from employees.	$ 15,852.33
(2) Accounts and deposits payable.	65,048.50
(3) Obligations for printing and distributing the 1959 Mechanical Catalog, bills for which have not been submitted.	27,440.00
(4) Unexpended appropriations for future services and outstanding obligations for which invoices have not been received.	170,228.21
(5) Future services to members who have prepaid dues.	306,246.80
(6) Subscriptions paid in advance.	13,138.00
Total	$ 597,953.84

To meet these debts the Society had:

(1) Cash in the bank.	$ 274,851.52
(2) U.S. Treasury Bills.	99,136.00
(3) Accounts Receivable.	202,373.34
(4) Inventories of publications and supplies conservatively valued.	205,711.30
(5) Securities at cost.	1,224,890.02
(6) Deferred expenses applicable to subsequent year.	4,639.13
Total	$2,011,601.31

The difference between the value held by the Society of $2,011,601.31 and debts of $597,953.84 is the net worth of the Society on September 30, 1959.	$1,413,647.47
Against this, the Society has set aside a General Reserve against contingencies.	1,000,000.00

THE SOCIETY ADMINISTERS A NUMBER OF SPECIAL FUNDS:

Custodian and Development Funds:	$ 630,917.86
Employees Retirement Fund:	203,265.61
Award Funds:	311,065.81
Total	$1,145,249.28

AGAINST THESE THE SOCIETY HAD:

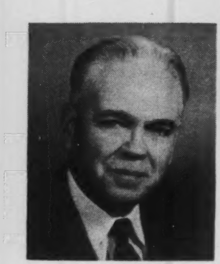
Cash	$ 251,318.93
Securities (at cost)	688,338.10
U.S. Treasury Bills	198,376.50
Notes Receivable	7,215.75
Total	$1,145,249.28

The Engineering Societies Building is owned jointly by the Founder Societies through United Engineering Trustees, Inc. ASME interest and other long-term assets are treated as a fully reserved fund.

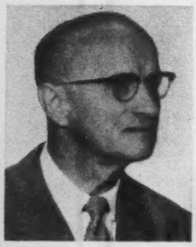
PROPERTY FUND OF:	$ 647,846.27

WITH THESE ASSETS TO SUPPORT IT:

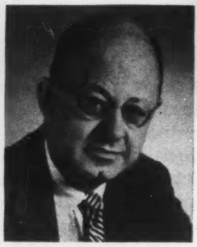
ASME quarter interest in real estate and certain other assets of United Engineering Trustees, Inc.	$ 498,448.48
Office furniture and fixtures (depreciated value).	149,396.79
Engineering Index, Inc., Title and good will.	1.00
Total	$ 647,846.27



GLENN B. WARREN



ERNST W. ALLARDT



LOUIS N. ROWLEY

RONALD B. SMITH

ARTHUR W. WEBER

Executive Committee of the Council

THE COUNCIL

Final decisions on the policies that ASME will follow come from the Council. This group of officers—the President of ASME, the three Past Presidents, eight Vice Presidents and ten Directors—are all elected by Society members. They normally meet twice a year.

Since more frequent meetings of the Council would be well-nigh impossible, as its members come from all parts of the country, an Executive Committee carries on the daily business of ASME. This Committee consists of five voting members.

Reporting directly to the Council to provide them with needed facts are the Committees on Finance, Organization, Professional Practice, and Constitution and By-Laws and the Boards on Technology, Membership, Education, Honors, Codes and Standards and Public Affairs.

Pictured above are members of the Executive Committee.

O. B. SCHIER, II
Secretary

MEMBERS OF THE COUNCIL 1959

President
Glenn B. Warren

Past-Presidents
Joseph W. Barker
James N. Landis
William F. Ryan

Vice-Presidents
Ernst W. Allardt
Henry S. Aurand
Charles H. Coogan, Jr.
Thomas J. Dolan
Harold Grasse
Gordon R. Hahn
John W. Little
Arthur W. Weber

Directors
Everett M. Barber
Elmer O. Bergman
Richard G. Folsom
Eugene W. Jacobson
Arthur M. Perrin
Louis Polk
Joseph Pope
Louis N. Rowley
Ronald B. Smith
V. Weaver Smith

MEMBERS OF THE COUNCIL 1960

President
Walker L. Cisler

Past-Presidents
James N. Landis
William F. Ryan
Glenn B. Warren

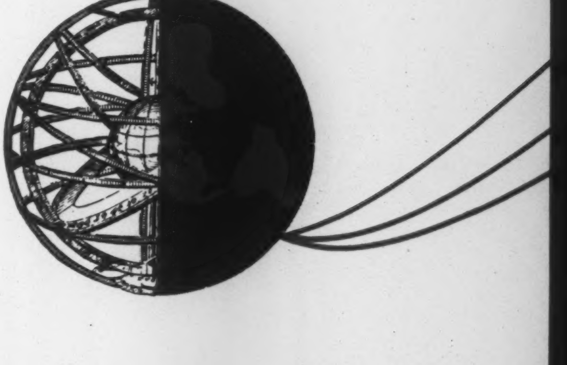
Vice-Presidents
Charles H. Coogan, Jr.
Thomas J. Dolan
Harold Grasse
Gordon R. Hahn
William C. Heath
John W. Little
Donald E. Marlowe
Henry N. Muller

Directors
Everett M. Barber
Elmer O. Bergman
Clarence C. Franck, Sr.
Richard G. Folsom
Eugene W. Jacobson
William H. Larkin
Arthur M. Perrin
Louis N. Rowley
Ronald B. Smith
V. Weaver Smith

Treasurer
Edgar J. Kates

Asst. Treasurer
Harry J. Bauer

Secretary
O. B. Schier, II



"The American Society of Mechanical Engineers—
an organization for promoting acquisition
of that knowledge which is necessary
to the mechanical engineer
to enable him most effectively to adapt the
achievements of science and art
to the use of mankind."

From original Certificate of
Membership of The American
Society of Mechanical Engineers.